# ‘SLOW VIOLENCE’ AND VACANT CITIZENSHIP: THE EXCESSES OF INDIA’S DIGITAL GOVERNANCE

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## Introductory Note

This essay emerged from a recent encounter with the tumultuous world of technology producers working to transition the Indian state into the realm of the digital. Expecting to be schooled in the technical apparatus of the transition, I interviewed, in 2018 and 2019, multiple engineers and technical experts in various roles, capacities, and inclinations. Yet, instead of a grandiose telling of the potential transformation to governance and life, these conversations revealed an anxiety about data, about the imminent dangers of the transition, and the sheer unpreparedness to tackle the still largely unknown but creeping threats that data posed. Categorized as hacks, leaks, malware, or SQL injections, these experts nervously warned that the gov.in was under siege from within and without. Far from the total and uncritical adoption of digital forms, these experts advised a cautious use of technological products, prescribing ways to wipe out one’s digital trail. Indeed, many made elaborate arrangements to leave no trail of their personal information on the computer systems they worked on.

In these conversations, the source of this danger was somewhat unspecified and, when named, not consistent. Sometimes it was Israeli hackers exploiting their weak information technology (IT) laws, sharpening their jacking skills on poorly protected Indian systems; other times it was simply bad design. Yet, the crisis was palpable and the discourse of the imminent danger was reaching scalar proportions. State governments were being forced to discuss it in their Question Hour and senior officials were laying out a counterstrategy in the form of hiring an army of ethical hackers to preempt and foil potential attacks. Media reports and other writing were bolstering these fears by quantifying casualties: ‘Over 22k Indian Websites, 114 Govt Portals Hacked between Apr 2017-Jan 2018’, read one newspaper report.[[1]](#footnote-1)

Standing for a moment outside this threatening present, one begins to see that the dangers being alluded to are in response to an original expectation from the juggernaut of digitization. This was an expectation of mobility, where information firmly lodged in government documents turns into mobile data, available as a knowledge input in the many decisions that make government. The deviance of data from this linear path toward something else is a phenomenon that comes after decades of the digitization machine at work, possibly a reason for the grave reactions toward it. There is a robust, if brief, history of the datafication of government, which is not often recalled but is a reference point of the current predicament. Historically speaking, what we see now is a situation I term excess. Excess or the excesses of digitization become a vantage point to illuminate the historical conditions and trajectory of digitization as a changing technopolitical assemblage of people, ideas, and technologies and their effects beyond expected outcomes. Other people interested in this history have asked and convincingly pointed out to the many political choices that have led to the present. In other words, we have some scholarly excavations of *why* digitization is in the state it is in. Somewhat uniquely, this essay asks not why but *how* we reached here. Also uniquely, the story of this how is revealed through a technological object: database management systems as a conglomeration of code and algorithms that came to define and direct the mobility of data, the dividing line between analogue and digital.

Relating the story of the present through a technical object doesn’t mean getting lost in the intricate technical details of management systems, fascinating as that might be. This essay aims to strike a balance. On the one hand, it is eager to point out remarkable shifts in technical configurations that initiated an altogether new direction and scale of the digital. The one big moment this essay highlights is the revolutionary innovation in coding data through algebraic relations that allowed manipulating it from a distance. To some, this may seem as a primitive technological past of the 80s and 90s. Yet, the reason I focus on revolutionary design of relational databases is because not much has changed in use by governments. There are very few examples of the use of non-relational databases in government (India’s biometric project Aadhaar is one example) and it seems like a procurement problem with governments all over the world, not just in India.[[2]](#footnote-2) On the other hand, the essay works hard to illuminate the social and political dimensions of these purportedly technical changes. How does an algebraic relation used to arrange data change our relations with each other and with institutions? Such a hyphenated inquiry encounters political concepts: neoliberal politics, rights, citizenship, access, and takes them head on. Unending servers of data at the 400-odd National Informatics Centres (NICs) strewn across India, leaching in and out of myriad computer systems, unsettle notions of neoliberalism exclusively built on a separation between state and market. Excesses in the form of hacks, leaks, and errors in data produce new obligations on individuals needing this data to exercise their basic rights. Excess offers a vantage point from where to view citizenship practiced and experienced as a tryst with broken data.

This essay is not simply about the social life of databasing techniques, even though a significant amount of space is dedicated to telling that story. It is, at its very core, the thick description of a total social fact that pervades all forms of datafication. Social facts are things external to individuals and specific situations, but have significant effects on material life. Databasing techniques are similarly concealed, but central to the movement of data, so as to not be seen or recognized as critical components to the story of digitization. Yet, as this essay reveals, they constitute the basis for the materiality of information. They give data a form and interpretive possibilities. They also, as this essay shows, make data potentially dangerous, going beyond the conditions of its arrangement.

**I**

## REMAKING GOVERNMENT IN THE REALM OF THE DIGITAL

## The techno-politics of neoliberalism

In 1993, Infosys recorded revenue of $5 million.[[3]](#footnote-3) One year later, that had jumped to $9 million on the back of Finacle – a banking system that centralized customer data to a back-end database system, while allowing a proliferation of service at myriad front ends: at the branch, in the home, or online. In a short period of time, Finacle went from 10 banks to 100, and then rocketed to 1,000 banks across 150 countries.[[4]](#footnote-4) A year later, in 1994, the automobile company Maruti introduced an Oracle database to keep track of a million moving parts in its Gurgaon manufacturing assembly, significantly reducing production time.[[5]](#footnote-5) Likewise, bourses in the mid-90s like the National Stock Exchange, the Delhi Stock Exchange, and the Pune Stock Exchange introduced a dual database and screen-based order-and-quote trading system that made multisited access possible.[[6]](#footnote-6)

What explains this momentous transformation in the sheer extent of data transactions in these diverse domains? Service, during this time, got a new name. From hugely deficit, long-waiting lines of poor service experience, India began to see quicker, multiple points of service access. Underlying this emergence of what has been called ‘modern services’ was a revolution in data storage design that crucially allowed access to data from locations other than where it was physically located.

In 1973, Edgar Codd, a computer engineer at IBM in San Jose, California, invented a new ‘relational’ way of storing data that would fundamentally transform how data was being accessed across the world. Called the relational database management system or RDBMS, he developed a system of symbols borrowed from algebra to define multiple relationships between dimensions of data. The format in which the data now came to be stored was the table, as opposed to a tree-like or hierarchical structure. This did two things to revolutionize access. It brought about ‘data independence’, that is, a separation of the application querying data from the structure of data storage itself, and it allowed access to data without the need for an underlying knowledge of where the data is stored on a disk.

This meant that one did not have to be a trained computer engineer to query a database. People with less technical knowledge (and possibly more business knowledge) could also formulate queries. With rapid increases in information communication through networks, widespread querying became possible from locations away from the data source. This gave businesses in the United States a phenomenal opportunity to analyze information from multiple locations and make decisions about stocking, pulling out, and pricing practically in real time. Between 1973, when Codd developed this model, and the early 80s, the market for RDBMS grew to, by one estimate, about $130 million.[[7]](#footnote-7)

RDBMS has sometimes been named, retrospectively, as a ‘disruptive’ technology. Materially, databases have been over the past 40 years surrounded, supplemented, and displaced by other forms of record keeping. Conceptually, digitization, or the process of turning analogue data into digital forms, is more often than not talked about, thought, and imagined as things that are encoded and represented in databases. The computer scientist, Paul Dourish,[[8]](#footnote-8) echoing an entanglement between prior technologies like writing and the practices they engender, says that ‘when the database is a tool for encoding aspects of the world, the world increasingly seems to us as a collection of opportunities for databasing’. RDBMS, and its ‘disruption’, was not simply a technical infrastructure, but rather an *assemblage of technical choices and political outcomes*. Studying it as a *cultural* phenomenon (as I do in this essay) has thus involved identifying it within a triad of database functions, infrastructural arrangements, and informational practice.

When this disruption reached India in the late 80s and early 90s, it was initially brought to life by IBM on the back of Rajiv Gandhi’s New Computer Policy that, after stonewalling foreign investments for a decade, now permitted their entry into technology production. As it did so, India found itself on the brink of another disruption. In 1991, when Prime Minister P.V. Narasimha Rao, after years of debate, finally dropped the axe on the liberalization policy, RDBMS was just about picking up. Indeed, this essay makes the (provocative) argument that the trajectory of post-liberalization would soon be fundamentally entwined with the trajectory of RDBMS as the infrastructure that came to define neoliberalism began to coalesce into its backbone, namely India’s growing service sector. Such an argument departs from the conventional history of technology development in India, mostly presented (for example, in a recent book by Mohan Sukumar)[[9]](#footnote-9) as the mute result of dramatic political choices. Likewise, liberalization has itself been conventionally viewed through a political economic lens of a withering state and emerging markets, and less often in its cultural impact on personhood.

While emphasizing what I see as the tectonic effects of a single technology, I do not elide the political; indeed, I hope to provide something of a techno-political account of post-liberalization in India: the ways in which political actions are embedded within technical forms and, conversely, technical objects shape political questions. Techno-politics, in its contemporary usage, often reveals engineering or infrastructure projects as vehicles for political goals and forms of power. It thus foregrounds political abstractions in a very material way. As a form of postcolonial computing, RDBMS can be seen as an assemblage of technologies, techniques, and desires undergirding shifts in neoliberal governmentality, enabled by significant interventions in multiple definitions of personhood that, in turn, define both privacy and surveillance as well as widen the domains of economic rights as these extend to the identification and targeting of beneficiaries. The *forms* of data that RDBMS helped produce across domains of life, including health, land, labor, and leisure, as well as the *channels* of circulation it opened up – from home to kiosk to data center and back – created a *radically new experience of citizenship*. The changes in the early 90s that many have seen as nothing less than a social revolution with significant legal, economic, and constitutional consequences were, I argue, undergirded by databasing technologies.

Let us consider some of the ways in which the entry of RDBMS helps account for the momentous changes that occurred in the 90s. One view on neoliberalism sees it as taking place autonomously, in what Thomas Friedman names ‘golden enclaves’ existing outside state institutions.[[10]](#footnote-10) A look at the ‘national’ career of technologies suggests otherwise – the founding of the call center industry in India that peaked in the late 90s, for example.

At its core, call centers allowed a translocation of services, produced in one (geographic, territorial, sovereign) region and consumed in another. What, we may ask, were the technologies that drove this? A lot of focus has been on the internet and networks in general, but young men and women in Bangalore, Gurgaon, and Mumbai were also accessing data that was stored thousands of miles away. Some were, inevitably, stealing that data and selling it to other companies – such as the famous case of an HSBC employee stealing bank information and money in 2006[[11]](#footnote-11) – but most of them were simply accessing personal, sensitive, financial data of their British or American customers through application interfaces that connected them to databases in those countries. Without several of the features of RDBMS, none of this would be possible.

Crucial here is also the role of service providers contracted to run call centers, build and run technology to access their client data, and offer services. The costing models, the lynchpin of the business of offshoring services, made sense only when Indian companies built their own technology and then charged their customers on a pay-per-use model. Companies like Genpact and Mphasis were now buying proprietary RDBMS from companies like Oracle and Microsoft to run their centers. Without that, it would have been prohibitively expensive to import RDBMS and to make the call center business profitable for firms abroad.

The point of this example is to show that tracing the career of technologies of neoliberalism such as RDBMS can *reconceptualize neoliberalism itself*, taking it away from Friedman’s golden enclaves and into entangled governmental policies (allowing the purchase of offshore database management systems in this case). It gives us another, *opposite*, way to think about the history of the present. Calls among neoliberalism’s leading promoters, such as the World Bank, have often been framed around advice like the trite ‘less government more governance’ line. But growing scholarship on both liberalism and neoliberalism has shown that lesser or leaner government does not necessarily translate into either less regulation or weaker states.[[12]](#footnote-12) Indeed, it proliferates the sites for regulation and domination by creating autonomous entities of government that are not part of the formal state apparatus but are instead guided by an enterprise logic. This is indeed the *techne* of neoliberalism, in which states ends up allying themselves with a range of other groups and forces, and seek to set up ‘multiple chains of enrolment’[[13]](#footnote-13) that mask the state’s persistent presence through ‘government-at-a-distance’ approaches to governance.

An oft-cited example of neoliberal governmentality, government-organized non-governmental organizations (more popularly referred to by the sonic acronym GoNGOs) too have been innate to the transformations of government, and mediate governance into the several new distributive possibilities that technological infrastructures increasingly allow.

RDBMS apparently illuminates this better than these new institutions can do on their own. To take one example,[[14]](#footnote-14) in 2012, Mother NGO or MNGO, set up by Chief Minister Sheila Dixit’s government in Delhi, conducted a massive GIS survey of Delhi’s homeless population to map their geographical coordinates and to create locative identities in the absence of residential ones. Inevitably, the data generated by the handheld GIS tracking devices that its surveyors used night after night (nighttime location being a credible way, the surveyors fathomed, to determine what they called ‘most visited location’) was stored on an RDBMS. Such collection and storage thus allowed access to multiple interested actors, including contracted surveyors, representatives of MNGO, organizations working for and with the homeless in Delhi, bureaucrats of the Delhi Urban Shelter Improvement Board, and the chief minister’s office in the Delhi secretariat. Every one of these actors could, via authenticating logins and interfaces, access locative IDs in real time. This allowed a previously unfathomable level of control and realignment of all of these agencies, and it also enabled a previously unimaginable partnership between state and non-state actors that challenged most received notions of either lesser government or more governance.

‘Participation’, another keyword freely doled out as a neoliberal expectation, also centrally features in projects that are on their face foundationally located in welfare, such as the Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MNNREGA), an Indian labor law and social security measure, often presented as an antidote to neoliberalism. MGNREGA’s entire logic of social auditing, a much-celebrated aspect of its accountability mechanisms, was enabled mainly by the ability of government officials and other multiple beneficiaries to query an RDBMS database (for example, nodal agencies both at district and central levels supervising the status of work, payment, fund utilization and fund requirement). This data helps government and citizens alike to in turn generate reports through which both participation and accountability are ensured.

## Digital Governance as a Stratigraphic System

My aim is not to pick a random set of government endeavors and show the value of RDBMS in them. My own examples, of call centers (a symbol of India decidedly on the route to becoming a service economy) and MGNREGA (as a prime example of welfare, at once a state-directed identification for future dole and a means of enabling participatory governance) are mainly to outline the latter career of two concepts – service and welfare – that have been foundationally connected to the grand narrative of India’s tryst, and eventual failure, with an industrial economy. Atul Kohli’s argument about liberalizing reforms as neither helping nor hurting India’s industrial growth[[15]](#footnote-15) is telling because it opens up a space to think about the *copresence of welfare with a neoliberal service economy*, despite the two being organized around different logics. That RDBMS undergirds elements of *both* welfare and service points to its centrality in shaping our populational experience as a whole.

What I want to take on here, as a specific object of focus, is the career of data and its storage within the story of the digitization of administrative government in India. This is a site where both the potential and the risk of RDBMS is at its most apparent. If RDBMS is the concealed infrastructure of big data, there is another concealment at play here: the vulnerabilities in data produced as a result of changes to its storage design. The career of RDBMS in government shows us that the modularity in the arrangement of data and better reach and access sits side by side with the risks this arrangement of data poses. When data was locked up on a computer – as it was in the earlier DBMS system – it had remained secure. Any threat of manipulation had in part been averted by the need to understand the basic structure of the data, something that was no longer necessary with RDBMS.

Nowhere were the perils more acutely felt than in government itself. Although the Indian state has been on the RDBMS wagon since the 90s, its bureaucrats and their consultants have only recently ratcheted up the conversation on data security. Although I recount older concerns with data security later in this essay, and while I show that security was thought about as early as the 80s, it appears that these did not curtail the movement of data that RDBMS brought forth. The trade-off (between data proliferation and security) is most evident in the digitization of the apparatus of governance itself. It also raises basic questions around how the proliferation of governmental data might be viewed within the present-day excesses of big data. Was there a *weakening* of the formidable forms of knowledge and control governments once possessed, and thus a phenomenological crisis in the state as RDBMS disperses data across locations and people?

This is a story that unfolds in a more or less stratigraphic manner.[[16]](#footnote-16) The paper files of colonial-style bureaucracy had a system – which database engineers hired by the Planning Commission in the late 70s and 80s abstracted and on top of which they built databases to serve the needs of their massive planning exercises. When other innovations, primarily RDBMS (but also Graphical User Interfaces GUIs and other forms of networked databases), were in turn built on top of *that*, it changed the organization itself and with it the flow of fast-digitizing administrative data. A new set of relations now emerged in the bureaucratic workplace, alongside an accretion of its functions and processes, each changing at different speeds.

What we now saw was significant: a slow descent into chaos, instantiated by spectacular leaks and hacks, mundane system breakdowns, errors and loss of data, all of which reveal diverse layers of techno-politics congealed beneath the benevolent-sounding term ‘electronic governance’. Viewing the digitization of government in archaeological fashion, as a series of layers, offers a history of the present. Although the researcher’s access to details of any single layer remains always incomplete, a through-line emerges *across* the layers, centered on the *choice* and *availability* of data management infrastructure with their accompanying political possibilities. Let me try to provide an outline of each of these layers, which map onto the sections below.

As far back as in the early 70s, India's Planning Commission – dogged by its recent history of ‘failed’ plans and frustrated by the poor quality of information available to it from various sectors of the economy – had sought ‘data improvement’ by constituting various committees. Since much of this information pertained to numbers, and since number-crunching organizations like the Indian Statistical Institute were already using computers and automatic calculators, the Commission decided early on to build computerized information systems. Yet the organizational forms of bureaucracy within which this information lay was notoriously opaque, with complex rules and minute levels of writing and inscriptions. This information was embedded in writing files and records with intimate channels of circulation and comprehension. The Commission soon realized that, before computerizing information, they had to first help bureaucrats in myriad ministries identify and digitize information most relevant to planning.

As I browse through the noting, comments, rebuttals, and replies that constitute the paperwork of these debates, now archived in another bureaucracy (the National Archives of India), a growing turf battle is discernible between scientists and bureaucrats. At the heart of these debates is the question of control over information. Thus, when budding Commission-supported computer scientists began considering, in the 70s, how to develop a digital information system that would aid the Indian bureaucracy in its production of knowledge about the world, as well as how to make that information available to other bureaucracies away from sites of action, they ran into two specific problems. First, *what* information from specific bureaucracies should be digitized and mobilized for action and *who* should decide this? Second, *how* should bureaucracies share this information, through what means, how much, and how often?

Attempts at digitizing (and subsequently computerizing) information on which public bureaucracies depended for their existence set loose a fundamental transformation in the nature of the information itself. In hindsight, the crisis was initially one of boundaries. If information production had so far worked through opaque rules and rituals of writing, all of which demarcated bureaucracy from the rest of society, how would the relationship of bureaucracy and society change when information once lodged in office registers now became untethered and mobile?

In the initial years of digitization, this relationship did not change very much. Early attempts at dislodging data concealed in dusty registers of district offices were, as I describe below, thwarted by available infrastructure. While these attempts aimed to make information move so that some center (either at state or national level) could see this information as data, movement began to be constrained by an overbearing fidelity to the organizational design of bureaucracy, to its hierarchies and rules, as well as to the computational design of information systems. In contrast, 30 odd years later, the mobility of information as data, in the era of let’s say Aadhaar, not only clogs the information highway, it storms into the lanes, cracks, and crevices of daily life.

There is no single metric to determine the extent to which government work has been digitized. But a range of examples exist that point to a huge transition into the digital sphere. A technical director from India’s National Informatics Center (NIC), which has spearheaded this transition since the 70s, told me that NIC servers receive over two million emails per day addressed to government employees.[[17]](#footnote-17) He said this makes @NIC.in the largest email service in the world. In 2016, the business magazine *The Ken* carried a long piece on the ‘appification of the Indian *sarkar*’ (appification of the Indian government), pointing out that the Centre for Development of Advanced Computing or C-DAC was ‘churning out five or six apps every month. Read that again: five or six new apps every month’.[[18]](#footnote-18) To point out how much data that must be producing, the writer says: ‘It’s happening at a scale so massive that there really is no comparison. Just for perspective, the United States of America has a total of 218 apps in its directory’.[[19]](#footnote-19) A land records digitization index, published by the National Council for Applied Economic Research (NCAER) in February 2020, shows that, barring four states, all other states in India have some form of digital land records.[[20]](#footnote-20)

Trying to excavate a chronology of digitization through reading technological infrastructures shows how RDBMS enabled a foundational national policy on the electronification of governance – the National e-Governance Plan (NeGP), a set of projects that includes the controversial Aadhaar project, to electronically provide governance at different scales.[[21]](#footnote-21) Much has been said about its conception of governance, about the financial investments it has attracted, and the kind of relations between people and states this has engendered. Very little, however, has been said (at least among people studying it as policy) about its technological structure, which at its very core instantiates a first, and eventually lasting, example of RDBMS in action within the domain of digital governance.

The NeGP structure is outlined in more detail later in this essay. In brief, however, it is made up of a core network of State Data Centres (or SDCs) – physical locations that contain the databases along with applications for storage, retrieval and manipulation of data, and maintaining cyber security – connected with intranets. SDCs further connected, through State Wide Area Networks (SWANs), to Common Service Centres (CSCs) that delivered services to multiple publics spread across thousands of geographical locations. The NeGP’s infrastructure *is* the form that a neoliberalized state in India has taken, made possible because of the distributed nature of RDBMS.

## Digital Excess

But transition into the digital sphere has been only one side of the story. Many of the examples I have pointed to above include within them reports of things gone awry. Of the two million emails received each day, 80 percent are some form of spam. In fact, the same director of the NIC mentioned above, runs a team whose sole job is to monitor the software that filters out spam and prevents it from reaching the email accounts of government employees. He says most of these attacks come in from countries with ‘weak or no IT Acts’, such as Israel, and many carry malware of various kinds, such as an ‘SQL injection’ that corrupts databases and ‘key loggers’ that copy everything typed onto another server.[[22]](#footnote-22) Such information, when identified, is supposed to be sent to the India office of the Computer Emergency Response Team (CERT), but that doesn’t happen every time. In early 2018, the Indian Parliament was informed that ‘114 government websites were hacked during April 2017 to January 2018’.[[23]](#footnote-23) Land record databases are, as we see below, being constantly reported as compromised. While hacking is used as a generic term to suggest multiple forms of divergences, the dissonance caused by the abundant production of data is also felt deeply within the daily working of bureaucracy in other forms, including errors and breakdowns.

In response to this excess, government agencies are hard at work to prevent leakage. Cutting across multiple overlapping attempts is the hiring of armies of ‘ethical hackers’ by the NIC and the renewed call (for example, in the overarching Personal Data Protection Bill, 2019) for a return to the localization of data.[[24]](#footnote-24) As a policy, the Data Protection Bill appears at times almost like a throwback to an era when organizational and computational limitations had also restricted the movement of data to local districts. The ‘local’ for the Data Protection Bill is of course not a subnational administrative unit, but rather the boundary of the nation. Nevertheless, in laying out rules to *curb* the movement of data, new policies are retrospectively consciously constraining the technical possibilities of RDBMS, thereby producing new political outcomes.

This is hardly the first time that governments have sought to legally control data movement in the name of security. In addition to recommending laws (not carried out until this present Bill), ‘third party audits’ and software logs to track changes made to databases had been introduced in the past. A common element connecting these myriad attempts has been the securing of data while *ensuring* its mobility. The proposed Bill, on the other hand, appears to want to secure data by *restricting* mobility.

Empirically tracing the emergence of information-as-data in the career of public bureaucracy reveals the consequences that it has had on the very existence of the bureaucratic institution. How did we reach a situation where data becomes unknowable and, in its mobility, uncontrollable? From static information, stored in registers controlled by a document keeper, to this onslaught of data – has this gone out of hand? To trace an implosive, if not regressive, element in the historical journey of a technology as it got applied to government is also to diverge from the overbearing, hagiographical, mode of writing technology’s history in India. As some critiques of science try to do, I hope to show that along the more familiar, national narrative of teleological technological modernity, lies a counter story of a phenomenological crisis in some of society’s most formidable organizational forms.

## Citizenship as Responsibility: Two Views

My focus so far has been on the effects of RDBMS on the *form* of the state. But if RDBMS is also *rearranging* the administrative state itself, what effect might this have on our understanding of a citizenship premised on state-endowed rights and entitlements? I have been developing an idea of service as a form of value which the technical arrangement of RDBMS sets into motion. I intend now to conceptualize what a service-based approach to *citizenship* might look like. I do this by thinking about how technical configurations like RDBMS aid us in forming neoliberal subjects with particular characteristics, and how this in turn produces an altered terrain of citizenship: for instance, a shift from rights to responsibility by shifting older patterns of power by attributing new technical responsibilities to citizens.

Citizenship has been discussed as rights demanded from the state, whether as consumers of services or as groups demanding affirmative action, but less often as *responsibilities* that the state attempts to place on citizens or citizens on themselves. Projects of development have often been thought of as collective national projects demanding contributions from all citizens, and yet the question of responsibility has not received adequate interest.

Individual responsibility, self-responsibility, or *responsibilization*, as new forms in which the governed are encouraged, freely and rationally, to conduct themselves,[[25]](#footnote-25) are a neoliberal hallmark in which citizenship recasts itself from a strictly juridical-legal relationship into a biopolitical mode centered on the capacity and resources of individuals to propel their own governance. The government, thus, in anthropologist Aihwa Ong’s terms, applies an ‘optimizing’[[26]](#footnote-26) technique to produce knowledge of its populations that crucially depends on an ethic of responsibility among its citizens.

Such an ethic of responsibility, one that technical arrangements such as RDBMS actively produce, is one of entrepreneurial governance producing entrepreneurial citizens. The stories of both people and institutions affected by RDBMS that I chart here point to a new breed of citizens working at the service of knowledge production and for a more precise government of the people. The many engineers, management consultants, computer scientists, and technicians appearing on the Planning Commission’s horizon right from the 70s, who continued to become permanent members of the government system, were also examples of such entrepreneurial responsibility, as were the business consultants and marketing men who spearheaded RDBMS into India and who took to multiple channels to advertise its positive effects.

I have in mind people like Narasimhiah Seshagiri,[[27]](#footnote-27) who built a network before the internet that could relay information about planning and development from one corner of the country to the other, and J. G. Krishnayya,a management consultant, who went to great lengths in getting the government to adopt a ‘systems thinking’ approach that could make planning and decision-making quicker. While pointing to specific kinds of individuals, I am interested in uncovering a proliferating ethic that rendered the problem of governmentality into a problem needing technical solutions through entrepreneurial design. This ethic, I intend to show, arose alongside the availability of databasing infrastructures: making a rarely-discussed reconfiguration of citizenship, bureaucracy, and technology in the redefining of the means of delivering welfare.

Entrepreneurial citizens generate projects that posit new relations between themselves and those that govern them in the form of an intervention or enterprise. The entrepreneurial ethic I find in the people that emerged alongside databasing technologies of governance is similar to, and yet different from, innovating entrepreneurs such as those that the computer science researcher Lilly Irani describes in her recent book.[[28]](#footnote-28) Like her innovators, these entrepreneurs focused on ‘progressive futures *for others* through organizations, know-how, and resourcefulness’ and have cultivated ‘an ethos of collaboration, experimental life, empathic civic interest, and the monitoring of possibility’.[[29]](#footnote-29) Unlike her innovators, the entrepreneurs I describe were more limited to transforming ‘thinking’ within administrative structures. Krishnayya, mentioned above, is a great example to think about the ethic of responsibility that entrepreneurs brought to government systems. Even before he was officially contracted by the Planning Commission to help build their systems, Krishnayya had already begun thinking and writing about what a systems approach to government would look like. The titles of his papers, which he sent to the government, sometimes unsolicited, reveal his sense of responsibility toward ‘improving’ government for a larger good. For instance, his papers titled ‘Information Services in Administrative Agencies’, ‘A User Oriented On-Line Computer System to Assist Decisions and Analysis in Area Development Planning’, ‘Fail-Soft Information Systems in Government’ were all written in direct and interventionist language and were meant to provide practical and yet transformative advice on how to change things for the future. He prescribed both ‘a new philosophy of information in government’ and ways to operationalize that philosophy through the design of data and systems.[[30]](#footnote-30) In Section II, I describe the development of this entrepreneurial ethos, propelled by new techniques of organizing data, which drove the datafication of a large number of government programs, from land management to identity and health records.

What we shall also see further on in this essay is a flip side to the story: excessive digitization and situations of disarray that point to another kind of responsibilization, marking a different form of citizenship. This is less associated with grand entrepreneurship and more with *repairing data affected by digital excess*. As I show in the case of a land records database, state processes download the labor of corrections onto farmers, who are then mired in a circuitous process of correcting errors ascribed to their data. In this process, their claims on the state vis-à-vis benefits and entitlements is temporarily halted, making for a shift from ‘thick’ or substantive citizenship to ‘thin’ and unsubstantiated citizenship.[[31]](#footnote-31)

Such responsibility is not only about keeping one’s data updated, which would have been the citizen’s responsibility under neoliberalism proper, but a different responsibility – one that nevertheless emerges from the fallout of that same neoliberal vision. For the kinds of *labor of repair* which I describe later in this essay are not bestowed onto citizens (like rights) but are instead tacitly elided by the state and its agents and shifted onto citizens. As men and women across the country are busy repairing their data, damaged as a result of the excesses of digitization, *citizenship is experienced as a form of violence*. This is not structural, spectacular, or episodic forms of violence that scholars of the state have alerted us to, but what I call a form of ‘slow violence’ given the slow and concealed way repair creeps into a citizen’s life.

## II

## THE PLANNING COMMISSION’S QUEST FOR ‘DATA IMPROVEMENT’

Many years before data governance came to be synonymous with the digital, the Planning Commission’s Monitoring and Information Division (M&I) had begun seriously thinking about an ‘Information System’ that envisaged nodes and flow of data. The conceptual and logical work generated around building this system – the debates over data and its flow – revealed the people in charge of building the system, their biases and preferences. Most of all, it revealed their undying belief in technology churning government inside out, their urge to make its ugly belly transparent, and to reveal the numerous offices and procedures that the Commission thought did not work, all to find ways to order and standardize them. Inevitably, the information system in the Commission became a record of a failure to stay the course of its mandate.

The failure was evidenced in three different ways in the forecasting and planning of the Commission’s third annual plan. First, in the unavailability of recorded information by the ‘sectors’ critical to planning for the economy referred to as ‘gaps in data’. This related primarily to agriculture and industries as the two main assets of economic production in the country. Second, in a ‘time-lag’: in the unavailability of recorded information in time for the Commission to make their plans. Third, in a disjuncture between the ‘formats’ in which information was recorded and sent from the sectors and of the Commission’s own recording methods – a problem of both ‘retrieval’ and ‘release’.[[32]](#footnote-32) All three added up to an informational crisis, one that the Planning Commission sought to resolve bureaucratically. The Planning Commission set up committees, but soon realized the need for technical consultancy to change the way data was created, digitized, circulated, and made available to the planning and reporting needs of the Commission.

The profile of the prosaically named ‘Data Improvement’ Committees now began to change from career bureaucrats and statisticians to computer scientists and management consultants. The administration of India’s future, the archive suggests, was being wired to a network of computers and their information capacities. Aside from the *zeitgeist* of computerization in the 70s – silicon bling in dreary bureaucracy – and the conceptual as well as logistical break from the past that computerization apparently allowed, it was eventually the limitation of the technical intervention, the limitation of databasing, that both defined and curtailed the Planning Commission’s work.

The limitation pertained both to *storage* and *access*. Before Codd had developed the RDBMS, units of data stored on a computer system could be traced out only by following a tree-like hierarchy of the system itself – Folder-File-Data – and were thus dependent on the configuration of the system, which in turn was under the purview of database administrators rather than users. This storage method limited its spread and access because dependence on the computer structure meant editing data could happen only on the system on which it was stored. At best, data could be read through remote connections to the storage computer, but this depended on the speed of the network and also the spread of the computer nodes, both of which lacked capacity. These limitations pervaded all decisions. From the prickly question of the centralization of data in the Commission to its existence in individual departments, from the meddling of engineers in bureaucratic decisions to the very transition from paper to the digital, the initial designs of digital stayed close to the paper system.

In April 1976, the Commission did what possibly no government agency in India had done before. It sent out a call for proposals to build its Computerized Data Bank. In a few months, it received detailed responses from five institutions: the Indian Institutes of Management in Ahmedabad and Calcutta, the Indian Institute of Technology Delhi, the Administrative Staff College of India, Hyderabad, and the Systems Research Institute, Pune. The Commission’s members weighed these proposals, gave each a sharp but generous review, and eventually decided, by June 1977, to give up the outsourcing plan altogether and to construct the data bank itself. That was a bold move for an organization that had very little experience with computerization, and they did eventually end up hiring ‘outside’ expertise. For now, at least, the Commission closed its doors to institutions eager to partner with it.

Yet, J. Krishnayya, the charismatic engineer from Massachusetts Institute of Technology (MIT) with some years of global IT consultancy behind him, and at the time the executive director and founder of Systems Research Institute that had sent the Commission new ideas on how to modernize its information system, continued to point the Commission to where it might go wrong with its plan to build a system. Not mincing his words, Krishnayya wrote an emphatic letter in May 1997 to the economist Raj Krishna, who had just joined the Commission as a member, in which he offered critical comments on the data repository that the Commission proposed to build itself, at least in the initial phases. A conversation ensued that would point to a lasting problem in the digitization of information: a problem that was to rankle in organizational design and would hover over the entire career of electronic governance in India. This was the problem of the *location* of data that the Commission was now aiming to centralize into a data bank. Should control of digitized data rest with individual departments or should it be centralized in a data bank? If planning by the Commission was essentially a centralized activity, should data follow suit? There was also the question of the form that the technology should take. Should technology *disrupt* the organizational form of government or should it map onto an existing morphology?

Krishnayya wrote matter of factly that the advice he had earlier given to the Commission, in the proposal in response to their call, was:

NOT TO BYPASS the Sectoral Divisions, but rather to link them into a network [with decentralized computer equipment]. The alternative, which is being followed now, is to construct a large central data bank administratively in one Division in the hope others will use it. Won’t happen! People want to control the information they use themselves. It will be a huge boondoggle eventually, and much wasted effort.[[33]](#footnote-33)

In their response in June 1977, the Commission defended its decisions:

The sectoral divisions are not being bypassed, but their information needs have been examined separately and an integrated system is being developed which would meet all these needs. The inputs for Data Bank would be collected and fed into the Data Bank by the individual Divisions. The role of the M&I Division is only that of helping in the identification, analysis and examination of information needs, design and development of the Data Bank, and later, it would be of coordinating the operation of the Data Bank by the Divisions concerned. It will, therefore, be seen that the Data Bank would not be “administered” by one Division but would only be coordinated.[[34]](#footnote-34)

In the inaugural issue of *sacm*, a monthly magazine that Krishnayya and his colleagues had started in 1979, he defined the problem facing the nascent attempt at digitizing government as a concern with the ‘application of System Analysis in Government, to problems of government, and government agencies, in the fields of Industry, Forestry, Irrigation, Agriculture, Communications, Transport, Urban development, etc.’[[35]](#footnote-35)

*sacm* aimed, uniquely, to begin a conversation about what would work for government *per se* without necessarily transitioning ‘solutions’ from the private sector to government. Nothing like *sacm* exists today, and the fate of that magazine is unclear. It does appear that its editors had aimed to generate ideas for the use of technology from within the contours and organizational depths of government itself. They invited government officers to contribute to the discussion of system analysis – a phrase that came to be used to describe both IT and organizational systems. Its inaugural issue, which incorporated papers from the file on building a centralized data bank for government, provides a clear description of what system design stood for at the time.

One essential principle that the editors of *sacm* proposed, for large computerized information systems in government, was the *decentralization of data*. This was to them an adequate response to the decentralized structure of decision-making among government organizations. This belief came to them from multiple and classic texts on organizations and system design, such as Katz and Kahn’s 1966 book *The Social Psychology of Organizations* and J.G. Miller’s 1978 book *Living Systems.* Another principle that SRI recommended in the pages of *sacm* was ‘distribution’, in response to a question of where information should be processed if it is to be made available ‘at the appropriate time and frequency and in the appropriate form to appropriate stakeholders’[[36]](#footnote-36). The editors defined the different scales at which decisions were taken as ‘echelons’, saying:

*Information-processing* capabilities needed to be ‘distributed among the various echelons’, depending on (a) the analytic capability required at each echelon, (b) the combined economics of processing and transmitting information. This meant that each echelon owns a certain amount of information-processing capability, though not necessarily a mechanized device.[[37]](#footnote-37)

Going further, to show a slew of negative effects of the opposite, that is, a centralized information system, the editors said that if centralized,

the raw data travels a greater distance [in terms of both time and space]. When the raw data travels more, there could be the following consequences: (i) the delays are greater, (ii) more errors creep in, (iii) communication costs more, (iv) in general the reliability is lower, (v) the context or the relevance [the metalanguage] of the data may get lost, (vi) inappropriate aggregation may result, (vii) reaction time with regard to new data ideas is long.[[38]](#footnote-38)

Importantly, they also pointed to the ‘political consequences of centralized processing’ in which they said that centralization led to the concentration of power at the center and a reduction in morale and decision-making of people in the echelons.

Essentially, Krishnayya’s critique was that the Planning Commission’s data bank was counterintuitive to how governance in India worked. If the Commission’s focus was to create a centralized data bank even as they strengthened the information systems of individual sectors, then its design needed to understand what kind of storing, retrieval, and processing of data would happen at which scale. Questions abounded on the technical capacities and structure of the devices that the Commission was putting together.[[39]](#footnote-39) While discussing the need for rephasing projects based on changing commitments and demands, the Commission notes: ‘How and where the cuts on the past commitments be affected and how to tailor the present budget accordingly […] is a problem situation to which an information system should respond’.[[40]](#footnote-40) In part this drew from Krishnayya’s philosophy that system design be based on fidelity to organizational forms. There was another reason why *sacm* was recommending decentralized storage of data: the databasing capacities available at the time. Technically, *sacm* recommended a database management system (DBMS), an IMAGE database system for its QUERY language. They claimed that the IMAGE DBMS was a ready-to-use tool for information management and hence ideal for a decentralized information structure. They, therefore, recommended installing the DBMS on minicomputers, with an RTE-III operating system that had a file manager, and installing these minis at the same levels as where decision-making in government was taking place. This, they believed, was a viable structure, and it would not disrupt the forays that the government had already made in decentralizing decision-making.

Until then, only large-scale, general-purpose computers had been used for all information processing applications. These monoliths had constrained the information system structure to the extent that, even in organizations where decision-making had been significantly decentralized, most information processing functions nevertheless remained centralized. With the rapid advance of minicomputer technology emerged ‘minis’ packed with powerful features, suitable for a location with small to medium requirements. Corporate users now had the attractive alternative of constructing, at all stages, networks of mini data centers, each equipped with low input/output devices and modular memory devices appropriate to the information processing echelons. Distributed minicomputer-based systems further developed the characteristic of ‘adding-on’ whenever additional processing capability was called for, thus allowing for possible technical evolution to stay in step with growing organizations.[[41]](#footnote-41)

The Commission’s centralized data bank inevitably ran into problems. It could not get individual departments to digitize their data in the formats that it had created, nor to reengineer their processes in ways that could streamline the flow of data from departments in the states and districts to the centralized data bank in New Delhi’s Yojana Bhawan[[42]](#footnote-42). Notes from a 1975 annual plan meeting between representatives from the ‘Industries Sector’, Centrally Sponsored Programs of the Department of Mines, and the Planning Commission point to some of the urgency and frustration evident among members of the Commission. That the Commission found that sectors could improve their control on the information they generated can be inferred from the following statement:

It was significant to note that the distribution of allocations vis-à-vis the strategies for project implementation i.e., holding the project, slowing it down or shelving it, was being handled through negotiations. Given the Data Base the same could have been achieved through recourse to a simple linear programming algorithm.[[43]](#footnote-43)

Later, in early 1978, the Commission ran into more problems with collecting data from the sectoral departments, even in the filling out of minimum standardized data record sheets. However, even if this had been sorted out, the flow and access of data would continue to be severely restricted in the absence of technical infrastructure to connect to the main computer in which all the data was purportedly stored. In this regard, some, if not all, of Krishnayya’s ominous statements about the centralized data bank would ring true.

But just when the Commission’s plans were failing, a new project emerged in sight. This was the creation of the National Informatics Centre, or the now-common sight NIC, housed under the Electronics Commission and partly funded by a grant from the United Nations Development Programme (UNDP).[[44]](#footnote-44) Since the NIC was a cocreation of the UNDP and the Electronics Commission, with the blessings of the Planning Commission, technical consultancy from across the world was being made available to put it together. An entire file dedicated to the debates, meetings, and decisions around the planning for NIC reveals the gigantic infrastructural changes it was bringing to life. UNDP described it as a project of ‘very great national importance – the scale and complexity of this project makes it a pioneering experiment’, and went on to justify NIC as follows:

A crucial requirement for national socio-economic planning and planned management is the availability of an extensive information system based on reliable data. Only then does it become possible to develop and to analyze policy options by employing, modeling and forecasting techniques.[[45]](#footnote-45)

NIC’s ambition was to conceptualize an information design and the flow of that information through the networks that it built, the most popular being the NICNET – a network before the internet that aimed to connect district offices across the country to a center. At first, NIC was less an organization and more like a network of computers. With the emergence of the NIC, it appears that Krishnayya’s idea of a decentralized information architecture that connected departments through a network was finally being taken seriously. It is, however, most closely associated with the computer scientist N. Seshagiri, one of its prominent executive directors. For NIC, in addition to establishing a supercomputer host in Yojana Bhawan in New Delhi which linked to several minicomputers in various sectors, there was also the work of building sectoral or department-wise data systems. This involved digitizing information in these sectors, and then creating a database management system for individual sets of data. NIC’s job was to create a standardized sectoral DBMS allowing sector-wise comparison, even when the data itself was stored in the Planning Commission’s supercomputer.

NIC launched this project with three priority data banks, or information systems, for three sectors that the Commission identified as having a ‘pronounced influence on the national economy,[[46]](#footnote-46)namely agriculture, manpower, and industry and technology. In each, the idea was to create a consolidated sector-wise data bank. So, for agriculture, information that would be related to agricultural products, geological data, meteorological data, oceanographical data, and hydrological data was collected as independent sets, with the NIC aiming to create a common system for all this data.

NIC’s goal was to achieve standardization by improving the way data could be classified *across* sectors. Classification of data in a hierarchical, tree-wise structure, a condition of DBMS, was necessary for easy retrievability. Ravi K. Zutshi, a consultant at the Planning Commission, noted that a coding structure was to be devised for classification that would distinguish between sectors, projects, and various categorizations that have to be incorporated in the database.[[47]](#footnote-47) A hierarchical coding structure was developed: (1) Industries Code; (2) Category Subcode; (3) Project Code; and (4) File Code. Different projects would then fall under one of these categories and would be given an individual number. A project code dictionary would have to be developed to provide easy access to the specific project in the centralized database. Since a number of files of information would be associated with every DBMS, a structure to name the files would also be needed. Zutshi proposed a hierarchy of ‘Sector File-Project File-Company File-Scheme File’. Other categories, beyond the four main ones, pertained to reasons for escalation and delay, and included a ‘scarce resource subcode’. Based on this categorization, project reports were printed out and made available to the Commission. In this way, data was made mobile in a standardized and tabularized format. These sectoral DBMS databases were to be hosted on a main computer in New Delhi, purchased by the UNDP, and linked to minicomputers in states and districts.

The Commission’s centralized data bank did eventually take off, but the infrastructural work of creating a network that would link the supercomputer with the minis, of designing the format for data storage in the DBMS, and, most importantly, of getting departments to input data in these formats appeared monumental in comparison to the amount of data actually transacted. The data bank, even when up and running, allowed for the transference of only a small proportion of data (compared to the Commission’s planning needs) and that too with glitches and delays. So, even when the digital had replaced the slow and unpredictable flow of paper that had frustrated the Commission in the first place, and created the need for a computerized data bank, its success was constrained by the vagaries of available infrastructure, the creative but tenuous arrangement of a network that produced only a trickle of data.

There were also political consequences, which resulted in something of a technical artifice. Organizationally, the NIC was imagined as a relationship between the Planning Commission and Electronics Commission. But that relationship was choppy from the very start. There are notes from Planning Commission members suggesting that the Electronic Commission, via the people developing the NIC, was trying to go beyond its mandate and decide what ‘information’ should be generated by the sectors. They were merely ‘physical technicians’, and it would be ‘odd’ if they gave suggestions like that. Apparently, the noting suggests, the Electronics Commission was obstructing the development of decentralized databases by individual departments and agencies.

Essentially, the Planning Commission aimed to create a separation between the people and the departments that would plan the data to be collected, stored, and retrieved, and those, such as the NIC, who implemented these plans by looking after the technical aspect of the information system. Such a conceptual-technical split has characterized the politics of NIC’s work with government departments and has over the years led to a gap between intent and outcome, evident from the checkered nature of digitization projects in government.

## III

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## DATA EXCESS: RELATIONAL DATABASE MANAGEMENT AND DATA PROLIFERATION

## Technical Specifics of RDBMS

The storage of data from a tree-based or network structure to one of rows and columns opened up possibilities for the arrangement and access to data that had not been fathomable before that. In database terminology, RDBMS changed the way ‘entities’, or pieces of information about the real world, could be represented and expressed. Such ‘entities’ included ‘real’ or non-digital representations of the world such as ledgers of land records, and ‘relations’ referred to the connection between them. RDBMS is, says one writer, a set of ‘relational database systems—which organize information conceptually in a similar manner to the tabular layout of a spreadsheet, but with concurrent access, transactional reliability, and a flexible querying interface’ that ‘ultimately became the dominant technology for storage and retrieval of structured data in commercial businesses and the de facto standard on the web’, providing the ‘technical core of a vast, global transformation of enterprise data processing and management’.[[48]](#footnote-48)

Rather than using pointers between entities in a network relation, and thereby enforcing some sort of referential link between entities (such as the hierarchical relation in the DBMS that the Planning Commission had built in the 70s), storage of data in tabular formats was not based on prior referential connection, but rather on the possibility of expressing those connections whenever desired. This difference can also be understood as the attempt of the networked model to mimic a real-world physical relationship into symbolic, tabular forms.

These differences between DBMS and RDBMS started becoming apparent to me as I began meeting database administrators.[[49]](#footnote-49) Most, if not all, were part of the NIC which has since grown from being a small part of the Planning Commission into a full-fledged organization. Most were young engineers who had worked for a few years on contract for the NIC or elsewhere, and had slowly been elevated into permanent employees. Many spoke about data security, some about design. In between rough sketches of tables, my notebook began to carry statements such as ‘design is both art and science’, ‘a good designer sees the database in his mind before he sets about building the database’. Called an ‘entity-relation’ (or E-R) diagram, these young database administrators (DBAs) claimed that they would use paper and pen to labor over the multiple relations that now appeared possible between ‘entities’.

Since the NIC builds databases for government departments that already have some form of storage mechanism in a physical format, drawing the E-R meant having to understand, from the ledgers and registers waiting to be digitized and databased, what relations existed between the entities. Engineers call this ‘domain knowledge’, accrued over many years of hanging out with staff whose work they aimed to digitize. I saw this repeatedly across departments. One or two DBAs would have developed close ties with some staff in the government office and that connection would seem to power the progress of the database projects.

Once the E-R was established through flowchart-like diagrams, the actual project began. Unlike a tree or network-based database structure, the E-R did not determine structure by itself, but instead showed all the relations possible between entities. Based on these relational possibilities, the entities were ordered into tables, with other constraints in mind, such as not increasing the columns of a table beyond 15. This was the background of tables. The front itself was an interactive screen that allowed for various combinations of the entities to be seen. Codd, when pioneering the database model, had stressed on this feature of RDBMS,[[50]](#footnote-50) and indeed the fact that people using it did not have to worry about the ordering of the tables or the E-R relations would be a critical component of its commercial success.

A critical aspect of this symbolic view of data was the technique of indexing or pulling up different sets of records and presenting them in a picture that allowed them to be viewed together in different combinations. Without indexing, databases had to be queried one record at a time, defeating the very purpose it was set up for, namely quick access to different slices of data. Indexes are built using unique identifiers (or the ‘primary key’ in database language) for every record. A ‘pointer’ with the location of the record in the disk on which the database is stored is created, so that querying a record means going directly to where that record is located. While the index itself is large, querying times reduce, taking us to the next inevitable level of multiple higher-level indices, created with pointers to an underlying index, and then to the data tables. This combined index structure, allowing a faster search, the addition, modification or deletion of records, or the ‘B-Tree index’, was invented in the 70s. In Castelle’s words, ‘without this technique, relational models would likely have remained as inefficient as their detractors often predicted’.[[51]](#footnote-51)

Such a relational model brought with it new ways of organizing data on a disk, and newer and faster ways of accessing individual records of that data. It also importantly brought about an accessible interface to the ‘casual user’ now no longer limited to the programmer and independent from the structure of the data on the disk. This software interface, along with larger random access devices (that allowed for many more locations for storing data tables), allowed for simultaneous work on the data from different locations, not possible in the prior models. This in turn enabled ‘on-line transaction processing’ or OLAP, made possible by the RDBMS defining criteria for online transactions.

The value of RDBMS began to be seen against the acronym ACID. It is worth understanding what ACID actually means, since this defines the expectations that corporate organizations have for RDBMS. *Atomicity* is meant to indicate that ‘individual transactions either occur or – if aborted – have no effect; *Consistency* *–* the data appears in correct, valid state all the time; *Isolation –* transactions are isolated from one another; this is equivalent to the appearance of serialized execution; *Durability* – successful transactions persist and do not disappear or become corrupted in the case of failures’.[[52]](#footnote-52)

At the heart of ACID was the desire for a robust system that would ensure ‘information retrieval’ of rapidly changing entities which organizational theorists had identified since the 50s as central to bureaucratic organizations. Yet, it wasn’t information in its entirety that was needed to be available all the time. Instead, like the management consultant Peter Drucker said of the business executive, ‘problems have to be presented to him in a form which allows him to act, that is stripped of everything not pertaining to the business of the moment’.[[53]](#footnote-53) By making databases ACID-compliant, information retrieval could happen selectively.

## RDBMS and the Entrepreneurial Spirit

Inevitably, the arrival of RDBMS in India became complicated. Given that it was specifically designed for commercial use in the US, its adoption by industry in India matched expectations. But, what of the government? Did government in India need or use OLAP and, by extension, did it need the support that RDBMS was intended to provide? Older engineers are surprised when I ask the question. To them, RDBMS has become so ubiquitous that it does not warrant discussion. They remember the NIC switching from DBMS to RDBMS as a natural progression of things, from the older to the newer. It was hard to get people to think about what value RDBMS was actually adding to their work. It began to appear that the significant leap in the digitization of India’s government, paralleling the growth of RDBMS in the country, was simply viewed in evolutionary terms.

While this is chronologically true, I shall challenge the assumption that RDBMS meets the same requirements in government as in the corporations it was meant for. More importantly, when one pays attention to *what* is digitized within government and *how* that stands in relation to its physical form, one finds that RDBMS may not have after all been employed in government for the reasons for it had been originally invented. Let us question its efficacy, in relation to the risk that is posed by digital data, by returning to the instances of leakage I had introduced at the beginning of this essay.

First, however, a short description of the promises and perils of RDBMS and the entrepreneurial spirit it gave rise to as it entered India in the 90s. In several of the statements of its early promoters can also be read a call for responsibility as a potential for better governance of the nation. Such a spirit would be further tied to the arrival of ‘experts’, different from incumbent bureaucrats and managers, leading eventually, I suggest below in my example of the digitization of landownership data, to a further weakening of control over data. Most significantly, it would lead to an ensuing shift in responsibility – from entrepreneurs to citizen-beneficiaries governed, in large measure, by new citizenship responsibilities arising from the excesses of entrepreneurial overattention to digitization.

The ten-year period between the late 80s and late 90s marked heightened activity in the marketing of RDBMS in India. According to a NASSCOM study, domestic RDBMS sales went up by 90 percent in 1994–95 compared to the previous year.[[54]](#footnote-54) The 200 firms established by the mid-80s in the US database industry selling ‘DBMS software, tools, and related products’, emerging out of the heady California ‘start-up’ days, were making forays into other markets, particularly in South and Southeast Asia.[[55]](#footnote-55) Firms like IBM, Oracle, Ingres, Informix, and Sybase had had an established presence in India by the mid-90s. Informix, started by a computer engineer at UC Berkeley named Roger Sippal, tied up with the Indian software firm IDM in 1989, the same year that it started offering OLAP transactions with Informix Online.[[56]](#footnote-56) Informix was the first to create an SQL-based RDBMS for DOS in 1986. The *Times of India* reported this alliance as revolutionary, for it ‘gives users decision-making powers by offering them access to information regardless of database location or desktop platform […] helping define standards that will make technology more accessible and affordable to users’.[[57]](#footnote-57)

Meanwhile, Sybase, best known for aiding the computerization of Wall Street in the mid-80s with its RDBMS software product made exclusively for Sun Microsystems’ client-server configuration, tied up with Hindustan Computers Ltd., better known as HCL, to expand their database sales in Southeast Asia. The alliance specifically offered ‘a Sybase solution along with database consulting, training and programming services’.[[58]](#footnote-58) Even though it was IBM where knowledge of relational technology was first generated (Codd was at IBM when he wrote his pioneering paper),[[59]](#footnote-59) it was Oracle that would be credited with the commercial success of RDBMS.[[60]](#footnote-60) In May 1991, Oracle opened a liaison office to ‘coordinate localization for India […] as a market with a lot of exciting potential’.[[61]](#footnote-61) Its major customer in India was the government – the Centre for Railway Information Systems (CRIS), All India Institute of Medical Sciences (AIIMS), Steel Authority of India (SAIL), and Centre for Development of Telematics (C-DoT).[[62]](#footnote-62) By 1993, Oracle had set up a fully functional Indian subsidiary, and Indian companies like Infosys, TCS, and others had begun manufacturing and selling RDBMS software.

RDBMS was also recognized and circulated as a specific computer skill, along with programming languages of the day, and advertisements for both students and faculty were put out regularly.[[63]](#footnote-63) Job calls for ‘programmers and system managers who had experience with RDBMS’ and even more specifically with Oracle or Ingres, were widely placed for both local and multinational companies.[[64]](#footnote-64) *Times of India*’s ‘On the Move’ section that tracked hiring and movement of corporate honchos, lists in 1993 the hiring by Datamatics of a general manager for RDBMS.[[65]](#footnote-65) In editorials, writers waxed eloquent about its transformational possibilities. Madhu Valluri, a regular contributor to the *Times of India*, wrote, for example, about how a computer system developed in the US to track and communicate environmental disasters could provide an ‘insight into what’s actually going on around us […] at a touch of a key’.[[66]](#footnote-66) Valluri complained that ‘today, not a single state government has access to instant information about the chemical composition of its rivers. Neither there is any biological information of its marine life’[[67]](#footnote-67), and setting up RDBMS systems would enable all of that.

Outside government, RDBMS was deployed in multiple industries – automobiles (for instance, Maruti introduced Oracle RDBMS in 1994 to keep track of millions of moving parts in its Gurgaon manufacturing assembly) and, most visibly, the financial sector comprising banks, stock exchanges, and other financial institutions. Further examples include deployment for a ‘screen-based order-and-quote trading system’[[68]](#footnote-68) for the National Stock Exchange, Delhi Stock Exchange, and Pune Stock Exchange. In the late 90s, after its success with Finacle, Infosys created BANCS 2000, an RDBMS for the banking sector offering an information system and decision support system under one roof[[69]](#footnote-69) that was later described as ‘a core on-line transaction product operating in 300 sites for 22 banks in seven countries’.[[70]](#footnote-70)

A specific challenge to the banking sector was posed by nationalized banks. Tata Consultancy Services was already in the fray for the automation of nationalized banks, which constituted by one estimate a market share of INR 250 crore.[[71]](#footnote-71) What these companies offered was a powerful RDBMS that would conduct the operations of ‘calculation of demand and time liability, fund and non-fund based advances such as loans, overdrafts and letters of credit. The software also took care of remittances, safe keeping operations and foreign exchange accounts’.[[72]](#footnote-72) Another writer speculated that a computerized system in nationalized banks ‘should be able to handle five to 10 million customer accounts and eight to 10 lakh transactions per day and at the same time provide acceptable response time per transaction’. He recommended a key technical requirement, a ‘relational database management system […] providing parallel server rollback and recovery along with features like two phase commit’.[[73]](#footnote-73) All that was missing was a ‘concerted marketing thrust’ to get banks to show ‘enthusiasm for computerization’.

This luminous career of RDBMS in private corporations, particularly financial ones, gave it a veneer of efficacy that was now being sought to be transferred into the realm of government. As with the nationalized banks mentioned above, commentators of the time found it surprising that governments were not adopting RDBMS as rapidly as they ought to have. To interrogate this roadblock – and thus to also interrogate the assumption that since RDBMS was ‘good’ for multisited organizations with a requirement for high transaction capability, like banks, it would also necessarily be beneficial for government – we need to make a distinction between *transaction-based* government services operating in multiple locations in huge volumes (such as the Indian railways online ticketing, an oft-repeated example) and the daily work of writing, recording, and filing inside government bureaucracies, the focus of technology-mediated ‘transparency’ reforms (such as the management of land records through databases, discussed below). While the former lends itself to RDBMS use, it is the latter that requires us to question RDBMS’ efficacy. Land records, when digitized, are not transacted online in the same way that bank functions are, nor is there any ‘intelligence’ generated from their arrangement in an RDBMS upon which the government acts. A land records database is as much controlled by a paper economy as the physical records had once been. These sites, I argue, have also engendered greater risk of leakage, leading to data excesses.

An example of successful use of RDBMS in transacting services offered by the government is that of the digitization of the railways booking system. By the 90s, the Indian Railways Passenger Reservation System (PRS), one of the largest and most important information systems of the Indian Railways (itself the world’s largest railway network) had begun to totter. Even while it was a functioning system, although it had expanded to computerized ticket reservation, it nevertheless required visits to the train station or to a PRS reservation office, and often the assistance of tourist operators. With low-cost airlines offering competitive prices and easier ways of booking tickets over the internet, the challenge before CRIS was to make a system on which PRS could be accessible from many more locations, including the home, and flexible enough to accommodate real-time updates. In other words, to meet the ‘service’ aspiration of upwardly mobile middle-class passengers. Unsurprisingly, these demands were believed to have been met by an RDBMS system.[[74]](#footnote-74)

Yet not everyone was convinced. A top official at CRIS said, ‘the benefits of emerging from changing over to a RDBMS from the current flat file system might not be commensurate with the resources expended’.[[75]](#footnote-75) Other sceptics within the ministry questioned its efficacy, or whether the need for passengers for ‘more avenues for reservation services’ could have been ‘met without disturbing the core of the system: in fact, world-wide, major high-volume ticketing systems were still being run on file-based platforms, rather than DBMSs’.[[76]](#footnote-76) Even as RDBMS in the railway reservation system has been seen as an important technology, a minority belief in the department has remained that the volume of transactions produced with ticket reservation going online with the Indian Railways Catering and Tourism Corporation (IRCTC) was possible even without RDBMS. Even so, RDBMS made possible a scale and distribution of service delivery that had been hitherto unfathomable before the use of relational systems.

What should be more visible to any researcher of electronic governance in India, but is rarely the focus of analysis, is where the technical possibilities offered by RDBMS have produced spillover effects that have hurt rather than helped the entrepreneurial imagination of governance. In these situations, RDBMS lends itself to performative impulses that substitute for the more straightforward practical opportunities that have defined what we have named the entrepreneurial spirit. From a purely empirical stance, such situations also depict the incommensurability of RDBMS for the linear hierarchies of administrative governance. But its continued and even celebrated uses for these exact purposes calls for an accounting of its *effects* which, I argue, are to be found in the shifting terrain of citizen responsibility in and of the data produced for their governance.

My main example to describe these shifts is the system of land records management that began to be used from the late 90s to centralize ownership data with RDBMS. Historically, the recording of landownership was a colonial enterprise, as has been widely documented. It was usually the responsibility of village accountants who had custodial control over their production and maintenance, and who became powerful figures in village economies as a result.[[77]](#footnote-77) In the late 80s, and following the World Bank’s belief inspired by claims made by the Peruvian economist Hernando de Soto that securing property titles could eradicate poverty, many countries vigorously took up the challenge to ‘clean up’ their records. Such a cleanup, often powered by the belief that the physical form of the record was in a mess, sought to digitize the record, usually in a first phase dedicated to ‘conclusive titling’ of land, followed by a documentary system that gave owners full and legal title over land (unlike the present, colonial-origin presumptive titling of land in India which does not guarantee individual title). Modernization of land records was closely linked to the belief that databases could provide the clarity needed to what were considered opaque practices of record keeping by village accountants. The concept was first formalized by the Planning Commission when India’s Prime Minister Manmohan Singh was still its deputy chairman.[[78]](#footnote-78)

In came a number of technology companies aiming to digitize land records. In Karnataka, Comat technologies first built a Fox Base DBMS system in the late 90s but then quickly transitioned into an RDBMS when it became more affordable.[[79]](#footnote-79) The same RDBMS database has existed since then, and other than offering itself as a digital registry for printing copies of land records, it has not been used for much else.

None of the original aims – creating a market in land, analyzing the extent of land types under the supervision of the government, all of which an RDBMS could enable one to do – have even been attempted. The printing of digitized records, its primary purpose, had been possible even with a file-based structure of storing data. In Haryana’s Kurukshetra, where a database was created around the same time as Bangalore, the architect, now the director of the NIC in Kurukshetra, complained that as a young employee building the database in the RDBMS ‘environment’ there were multiple opportunities for ‘analytics’, but he had not been given the opportunity to explore any of this.[[80]](#footnote-80) On the one hand, senior bureaucrats have claimed that land records have been modernized through technology, and have received national and international appreciation for this. On the other hand, the undergirding of this apparent modernization with RDBMS has not been exploited to perform any kind of analytical work on the records. The irony of this is not lost on observers, who point out that India’s prowess in IT does not seem to be applied to its modern land records.[[81]](#footnote-81) In essence, even when land records *were* digitized, their production was never separated from the dense practices of paper-based verification and authentication. The figures and numbers seen in the database are only the symbolic representation of an intricate process of record creation located between the field and the office.

## Locating Excesses of Digitization in the Structure of RDBMS

Even while RDBMS databases have not made land governance more ‘intelligent’ – arguably the key purpose for which these databases were set up and aggressively marketed – has it made the *management* of that data more risky? In this transition from records in physical registers to records on a database, multiple aspects of control have been compromised. First, the already existing gap between what is actually happening on a piece of land and what records signify has only further widened. The reason usually lies in the very processes that had brought database to life for, even as databases marked a disjuncture from the practices of village accountants, its original architects depended on those very accountants to verify the first version of digital records. They were often nothing but physical records typed by young men and women working on poorly paid contracts for the government. Verification took so long that the status of the land had often changed by the time digital records were finally approved.[[82]](#footnote-82) Far from becoming intelligent, the quality of information in fact suffered, not to mention the copious amount of time invested in sorting out these errors.

A second, more technical, question lay around storage and access, and the potential for manipulation. The RDBMS for land records in Karnataka includes an entity called ‘surnoc’ or survey number character denoted by a ‘\*’. This asterisk had been included in the database as an identifier for the first parcel of land split from a bigger plot. For instance, for survey number 32, if a *hissa* or split is recorded by one of the joint owners, the first split gets survey number 32\* to differentiate it from the original number 32. This convention was originally created when the database was built, and it was discovered that previously split land was not being given a separate record. What the database architect didn’t consider was that putting in a \* for any survey number in the database – that is entering a \* in the surnoc column – generated a *new* legitimate record that could be legitimately used for legitimate transactions.

A senior bureaucrat explained how in an office in his charge, a series of such offenses came to light when a new database operator accidentally gave a farmer the ‘wrong’ version of the record, that is, a version created by a ‘surnoc’ or duplicate to an original survey number. On the basis of this new record, the unscrupulous operator, according to the bureaucrat, took loans that the farmer was shocked to now discover. On hearing this, the bureaucrat telephoned the main operator manning the centralized database and asked him to dig out all cases in which new false records were created using the surnoc. A litany of cases emerged, operators were fired, and conniving village accountants slapped with criminal cases. The bureaucrat ended this story by saying that this problem has now been fixed by another new and more tech-savvy commissioner of land records in the state.

These were only some of the instances of the many problems that RDBMS databases had created. Even with the new commissioner, multiple cases arose of ‘breaking into’ the database to make changes. A case was reported in 2018 in which 19 acres of government wasteland were transferred to a private individual.[[83]](#footnote-83) The report also claimed that it was the third reported time such a ‘breach’ had occurred in which government land was transferred to private people. It is interesting that the commissioner chose to respond by differentiating a ‘breach’ from a ‘hack’, saying that the ‘Bhoomi software cannot be *hacked* at all’[[84]](#footnote-84) and that ‘in both cases, some person has *breached* the security and logged into the system to change the database’.[[85]](#footnote-85) It could not be hacked from outside the institution because it wasn’t online (there has only recently been some move to create an online database for Bhoomi), and not because there was anything inherently insecure about it. In the literature, a ‘security breach’ includes ‘*unauthorized data observation,* *incorrect data modification, and* *data unavailability*’.[[86]](#footnote-86) The records in Bhoomi have been found to be replete with missing information – discovered, on several occasions, in different versions of records printed at different points in time.

More importantly, the commissioner’s remarks obscure the fact that it was the very village-level records in their physical registers, and their process of being databased and stored in the subdistrict, that created the conditions for this violation. Databasing by its very nature, and particularly RDBMS with its tables and easy format, provides the opportunity to access and change data. In database terminology, such kinds of invasion are called ‘direct attacks’ as ‘the attacker can easily attack the database as it does not have any protection mechanism’.[[87]](#footnote-87) The not-so-user-friendly file-based structure of the database is often more secure against intervention, an unintended consequence of design since a user needed to know the structure of the database in order to access it. In RDBMS, on the other hand, any access to the SQL program that interfaces the data behind it also allows access to database tables.

One way of securing such access was by introducing an encryption key that made the data unreadable, as the commissioner eventually said about the land record data under Bhoomi: ‘As a first step, we are encrypting the whole of Bhoomi data. This will prevent even officials from seeing the database’.[[88]](#footnote-88) Encryption has been a long-standing method for securing data in RDBMS, the literature pointing to many kinds of tools and techniques for such encryption to prevent ‘intrusion’.[[89]](#footnote-89) There have also been critiques of encryption itself, such as the argument that it can ‘significantly degrade the system performance and application response time’.[[90]](#footnote-90) Encryption remains at best an incomplete solution to the basic problem of ‘security threats’ that Geertz and Jajodia suggest arise from the following basic fact:

Today’s often mission-critical databases no longer contain only data used for day-to-day processing by organization; as new applications are being added, it is possible for organizations to collect and store vast amounts of data quickly and efficiently and to make the data readily accessible to the public, typically through Web-based applications.[[91]](#footnote-91)

Scholarship on data security often starts with such observations: ‘As organizations increase their reliance on, possibly distributed, information systems for daily business, they become more vulnerable to security breaches even as they gain productivity and efficiency advantaged’.[[92]](#footnote-92) Even though Bhoomi does not (so far) operate on the web, its data is spread across databases connected via leased lines located in multiple subdistricts, and there are plans to connect them into a centralized web-based architecture. In this situation, encryption is admittedly a way forward, but it has its limits.

Data finds new locations with RDBMS, even as concerns for data security recommend limiting ‘access’ points or making the data unreadable through encryption. This ability of data to be located in multiple locations in the same tabular formats allows for *an imagination of modularity*, alongside a *replicability of homogenous form across varied contexts*.

Such an imagination would, in 2006, undergird the ambitious NeGP: a densely packed policy for digitizing all government administration and services across many domains of life. The NeGP is often seen as having brought together a trinity of material forms in its effusive modernization project. Called ‘core IT infrastructure’, this included leased internet lines integrated into a State Wide Area Network or SWAN that offered high speed connectivity between web applications offered at CSCs but which were actually stored in SDCs. This was an institutional arrangement for the maintenance of databases and networks at a single fixed location in the state capital. Front-ends of the application, producing say birth and death certificates available at CSCs, would be produced through SWAN’s link to a back-end linked to a data center in the state capital. All this operated entirely on a client-server model enabled by RDBMS.

A guidelines document lists several features expected of RDBMS for developing applications stored in SDC. The RDBMS should, it says, ‘support data base partitioning and parallel processing’, ‘have support for generation, consumption of XML data and XML based query capabilities’, ‘allow multi-dimensional OLAP capabilities for Data Warehousing’.[[93]](#footnote-93) It further suggests that the RDBMS should adopt industry standards to ensure interoperability between databases.[[94]](#footnote-94)

A couple of years after RDBMS began to be employed for applications, a study conducted by two computer scientists for 14 e-government services in the state of Himachal Pradesh in north India in 2010 concluded that ‘the development of e-government applications invariably lacks conforming to standard database design parameters’.[[95]](#footnote-95) They found several problems of multiple parameters of database design, important among them being the absence of primary or foreign keys which greatly reduced the ‘referential integrity’ or the validity of the relation between two tables, absence of a ‘constraint mechanism’ to verify data that can enter a database and ‘poor E-R design’ that pointed to the fact that databases had not ‘developed any conceptual schema and databases are designed on ad hoc manner’.[[96]](#footnote-96) The last two aspects pointed to reduced security measures in the databases, as unverified data entries and poor E-R design could make databases open to breaches or attacks. Many of the databases were made by the NIC in Himachal Pradesh, and it is possible to find similar problems with databases in other states as the NIC is known to share its design principles.

## Repair of Data and the ‘Slow’ Violence of Excess

That databases being built for government are falling short on design and security is one aspect of the problem. A more trenchant issue is the ‘breakdown’ of data produced by the *excess* of the technical structure of RDBMS, as we have seen with Bhoomi. A significant and under-discussed aspect of this breakdown is the labor involved in the repair and correction of data, and the way such labor has been shifted onto the citizens. Claims to citizenship through access to rights and entitlements depend increasingly critically on this responsibility of repair, so that for many people citizenship is experienced only through the practice of data repair.

This is not the same as the neoliberal impulse of responsibilization, where citizens keep their data updated in their own best interest. What I am trying to point to is an unintended fallout of this impulse – a fallout of precisely the opportunity promoted by RDBMS, through technologies of government to sort out citizen-subject relations in a discrete and transactable fashion. Just as claims to rights and entitlements are made unequally, repair too is practiced unevenly. This is not a problem of capacity, rather it is the concealment of data error within ongoing material disruptions between citizens and states. When citizens are required to bear the responsibility of repair, it is not a visible transfer of responsibility, rather it is a tacit, neglected, fringe encounter, embroiled within ongoing material disruptions between the citizen and the state.

Before I turn to the empirical example to support all that I am saying here, let me propose one final outcome of this form of unintended responsibility emerging from relations produced *through* the very technical opportunities that RDBMS offers. Violence, disaster, and breakdown are familiar experiences when negotiating with states. Experiencing citizenship-through-repair is often not a spectacular crisis or disaster, nor is it a stark infrastructural breakdown or the choking of infrastructural time. Repairing data is instead best viewed as temporal vacuity, a state of limbo, a temporary break from ongoing relationships. It is not structural violence in the usual way of describing state procedures (though there is some overlap). Nor is it spectacular violence. I propose to think of it as a temporary, circuitous low-grade suffering, and so a form of ‘slow’ violence that scholars have begun to attribute to the slow-moving temporalities of suffering.[[97]](#footnote-97) *Such violence of data repair, as a mechanism of citizenship, is slow because it proceeds at a speed that distances suffering from its original causes*. Repair is embedded in familiar structures so that citizens are unable to any more distinguish the repair of data from the other bureaucratic processes within which they are often mired.

I continue, as I now explicate this pattern of digitization and data repair, with my example of land records digitization and its database-driven excesses. We turn now to the repair work that goes into data rehabilitation. The split experienced between the digital record itself and the paperwork that continues to surround it is experienced by farmers as a form of harassment – often physical, involving multiple trips to offices, courts, hiring and paying advocates, waiting for months sometimes years to have their errors resolved. It produces a growing disjunction between the overt promise of transparent, speedy, and clear databases, and the substantive experience of vacuity produced by the errors – a form of ironic, symbolic violence.

A few pointed out that people have been urged, since the turn of the millennium, to become ‘e-citizens’, to conduct their business with the state online. Encrypted, barcoded, digitally signed land records can be printed out from internet cafes boasted a young engineer, a Bhoomiconsultant. But, as often is the case, when it was revealed that the record has something amiss – a name wrong, the extent of land incorrect, missing information about the crops on land, in essence a record paralyzed in an identification-based ecosystem of entitlements – people were asked to go back into the dreary world of paper records and fish out from the dense physicality of the paper record room the claims about who you are and what you own.

The rehabilitation of these digital errors opens up another side of the process, namely the administrative-legal procedures of record keeping and record rehabilitation. In order for an error to be corrected, it must first be made legible to the bureaucracy. This is done by reinscribing it as a ‘dispute’ between the owner of land and the head of the office to which the record belongs. A dispute calls for a specific arrangement of documentary material with specific inscriptional work, described below.

Once presented as a dispute, it is put through a revenue court process in the office of a senior bureaucrat, higher than the head of the office in which the error, now renamed dispute, is lodged. The court process takes its own discursive path, ending up in an order that either accepts the applicant’s request for correction or rejects it by asking for more supporting documents. If accepted, it comes back to the office where a ‘mutation’ process begins to make changes in the digital record. This entire process points to why a digital error cannot be corrected digitally, since an error is not identified simply as a typographical error and thus becomes a much more complex legal problem.

A specific feature of the correction process is that the law, on which the bureaucratic process is based, makes it incumbent on the *owner* to prove to the bureaucrats that there is indeed a correct version of the data that is identified as erroneous. This is irrespective of the source of the error. The effects of such a transfer of responsibility were made starkly apparent to me in a conversation between an owner and a Bhoomi operator who had just made an error on his application for change in the record. The operator had incorrectly entered the wrong name for a particular record, and the application had now left her ‘login’ which meant that she could no longer edit it. As part of the state government’s ever-evolving strategy of gaining further control on the production of the record, deleting an application at the office level was not an option any more. When the next bureaucrat in Bhoomi’s workflow sequence received it and verified the owner’s name on the screen with what was in the copy of an older paper document, the *Aakar Band* provided as part of the application, she marked the application as an error. At this point the application left the ‘mutation’ flow and went into a ‘dispute’ list of cases that now needed a scanned court order to be put back into the mutation process. The owner in question was, in the operator’s words, ‘scolding’ her for making this mistake as he would now have to run around to have it corrected. The owner bears the brunt of the state’s centralizing logic that, as becomes further evident, draws heavily on a colonial logic in which an owner’s rights are presumptive on her ability to prove at every point in time that her records are indeed correct, in order to continue to validate the authenticity of the record and thus to produce the ethos of fairness and transparency attached to data transaction.

The correction of records often involves chasing files in a circular fashion as they move within multiple government offices and as clients move from office to office. Not every record holder makes all these trips in person. Sometimes these are mediated by brokers or advocates who represent record holders in revenue courts, or by office clerks themselves for a fee. Essentially, record holders have to strike a balance between bearing the burden of running around by themselves at the cost of losing out on working on their farms or paying bribes to have it done for them. This depends on the socioeconomic status of the owners, with rich landowners (identified locally as people owning 15-20 acres of land) being able to afford bribes to hire mediators to do the job. How soon a dispute will come up for hearing depends on how networked the advocate hired is with the office clerks and how much money the record holder is willing to pay to get the job done. Even when admitted, cases take multiple hearings to finally produce an order. The magistrate sometimes asks the record holder or his representative to return with more documents to bolster the file. Building a file becomes an accretive process, and the only way documents are accepted is through physical submission to the magistrate.

The Bhoomi operator, whose case I described above, said that ‘caseworkers’ – clerks of the processual side of bureaucracy – do not work on these files quickly enough. For them it is often merely a ‘drop in an ocean of files’, and they need to be adequately compensated for the job. Once an application is marked as ‘dispute’, it falls out of the First-in-First-Out (FIFO) system (a much-advertised feature of Bhoomi), after which it depends completely on the whim of the caseworker. There is no accountability mechanism to track when an error file will come up for hearing and resolution, thus making people visit offices multiple times to check on the status. Court sessions are often cancelled because the office head is busy with other pressing work, but there is no way for record holders to know that unless they read the notice board. As a result, offices teem with large numbers of record holders hovering around the desks of office clerks in charge of handling the correction file, or in front of the court room where, in performative fashion, the head of the office will receive documents from them to add to their file as proof of their ownership.

For citizens, repairing Bhoomi data and thereby recovering their status as claimants of substantive citizenship (as opposed to legally ascribed thin citizenship) requires stepping back into the quagmire of paper bureaucracy. Here is where the first kind of entrepreneurial responsibility, of the kind that technical configurations such as RDBMS have spurred, trails off and the burdensome responsibility of the citizen emerges. The digital service of maintaining land records is put on hold until resolutions are received. This is a critical moment of reconnection with a past that had been ostensibly discontinued when the storage and dissemination of records had been made digital. The back-and-forth between owning data and being a legitimate subject of citizen services, and being saddled with the burden of repairing data and losing that status, depicts the experience of slow violence emerging in these interactions.

## IV

## CONTAINING EXCESS OR RETURN TO THE LOCAL

One startling aspect of the proposed Personal Data Protection Bill in India in 2018 was its suggestion that the movement of data be curtailed by compelling organizations to store data *locally*.[[98]](#footnote-98) The Justice B.N. Srikrishna Committee report on data privacy says: ‘A policy of storage and processing of personal data within the territorial jurisdiction of a country is advocated to ensure effective enforcement and to secure the critical interests of the nation state.’[[99]](#footnote-99)

‘Local’ here meant *national*: that is, data produced in the country should remain in the country. If this becomes law, it will singlehandedly upend the relationship between technological infrastructures and globalization. There are many technologies of globalization, and databases are one of them. As Benjamin Baez argues, databases are ‘informational technologies leading to a new communication system, one increasingly speaking a universal, digital language and integrating globally the production and distribution of the words, sounds, and images of our culture’.[[100]](#footnote-100) In other words, databases are what make movement from local to global possible. Recall that RDBMS was a commercial success because it was marketed as a solution to the problem of organizational spread *across* geographies. In Grier’s words, ‘Codd developed a structure that allowed business people to focus on certain kinds of relationships. These relationships determined how businesses thought about their customers, their bills, and their employees’ *across regions*.[[101]](#footnote-101) In fact, Grier compares the organization of the World Wide Web to Codd’s relationship structure: ‘It [the Web] was clearly built upon the ideas that Codd developed. Those ideas could be seen in the databases that supported the Web, spreadsheets, and even in the organization of data scratched hastily on a pad of paper’.[[102]](#footnote-102) If RDBMS (or other such technological infrastructures) are now restricted to national borders, the change they will inevitably undergo is right now unfathomable.

Going ‘local’ is the Indian government’s most aggressive strategy yet to prevent what I am calling ‘excess’, but it is definitely not the instance where the state has tried to comprehend data security. At the heart of data localization is the question of whether security is inherently related to the physical proximity of data. What distinguishes the Indian government’s past attempts at data security has been that control over data has actually *centered on its mobility, not its containment*, arising from the foundational concern for keeping *movement* of data alive. Whether it was in the calls for legislation to counter the risks of data theft as early as the 70s, as I discuss below,or the development of a multination standardized framework for conducting information technology audits in government, security has been thought of in terms of speed and mobility of data. Calls for localization as a form of containment in a bid to counter excess can transform the entire attempt at digitization that this essay has tracked since the mid-70s. In this section, we trace past attempts at securing data against excesses to point to different strategies employed, by both state and non-state, and contrast these with the present attempt at data localization. This is not an argument either for or against data localization, rather it shows how, in returning to an imagination of immobility of data when it exists in physical registers, we are seeing a return to an earlier imagination. This return is even more startling when viewed against India’s ongoing history of securing data through emphasizing mobility while searching for ways to limit excess.

A starting point for tracing the genealogy of the government’s concerns with data security could be the early years of information digitization, in the late 70s, when multiple government agencies first began experimenting with centralized data centers. A seminar conducted at the Indian Institute of Public Administration in 1979, perhaps the first time that security threats to India’s steady march toward digitization were discussed, opened with an evocative lecture on the perils to privacy. Justice Krishna Iyer, who would retire the following year as judge of the Kerala High Court, made an emphatic appeal to his audience (whom he addressed as ‘Scientists, Sociologists, Administrators and Friends’) to think seriously about the security of data: ‘The problem before us is temporal – how to tame and train electronic power for the Human Cause but this is also a problem of value judgement and moral consciousness – a profound commitment to the dignity of man and progress of the world community.’[[103]](#footnote-103)

The need for data’s *transcendence from the territorial* – which the authors of the Personal Data Protection Bill today suggest needs to be curbed through a legal prevention of the flow of data – is already identified in this early talk by Krishna Iyer. The threat of security emerged from the fear that data may go out of hand, leading to a situation of data excess:

The consequence of the combined achievements of the computing and communications technologies is that data collection and transmission is becoming massive in its quantity and apparently limitless in its capability. Its speed increases as its cost diminishes. Unrestrained by law, it will know no national borders […] the notion that the State can control flows of information, difficult enough with paper and manual files becomes more difficult with instantaneous transmission of information through computer terminals in other countries.[[104]](#footnote-104)

Even so, Krishna Iyer did not recommend localizing data in the way the Personal Data Protection Bill recommends. His expectation from the law was to provide what he called ‘pre-emptive action’ against attacks on security, sometimes belied by his distrust of the ‘average lawyer and judge’ whom he considered ‘illiterate about designing privacy legislation suitable for the computer age’. Nevertheless, he believed that strong legal safeguards for security was the only way forward.

It is an irony that having given this lecture at the very beginning of the massive digitization attempts of the Indian state, Krishna Iyer would, toward the end of his life, fight a bitter war against Aadhaar for breaching personal security.[[105]](#footnote-105) What followed, in the years after his lecture, were state-led interventions for instilling security that ranged from creating committees and reports to hiring ‘ethical hackers’. Soon after Krishna Iyer’s lecture, in 1980, a Committee/Panel of Specialists in the Department of Electronics, set up in the Electronic Commission to advise it on ‘problems of ensuring security of information while using electronic data processing (EDP) equipment’, submitted its final report.[[106]](#footnote-106) The report consisted of the work of six working group committees to draft guidelines on various aspects of security. These groups included members from the NIC, the Intelligence Bureau, the army, scientists from Tata Institute of Fundamental Research (TIFR), and civil servants. The report that they produced was detailed, covering multiple aspects of data production and communication. But as a Special Invitee to the final meeting of the committee from the Ministry of Law and Justice pointed out, data processing activity in India in general was at an early stage and depended heavily on the experience of the West, discernible from the list of references. The language used to justify the report seemed, he appeared to suggest, out of place with the nascent nature of database development in the country. In hindsight, we may now infer that this was possibly only appropriate to the later moment of RDBMS development. It said, ‘shared resources and jointly used data have become the normal mode of computer operations’, which made the issue of data security or ‘the protection of data against unauthorized disclosure, modification, restriction, or destruction’ especially critical.[[107]](#footnote-107)

The synchronous use of data was hardly a feature of the databases operating in India at the time. Neither was a ‘direct interaction with computer’ – once the prerogative of the programmer or operator, now a ‘common place activity for the most casual of computer users’ – much in evidence.[[108]](#footnote-108) It appeared that data security in the 80s was seeking solutions to problems that had not yet arrived. Even so, there was detailed focus on the problems arising from making data mobile, as members of this committee braced themselves for the excesses of data that they realized would soon arise from the multiple paths that data would traverse across the country. Under the subsection ‘Data Base Security and Communications’, the report explained:

When multiple users are accessing centralized data through terminal devices from remote locations linked to a central computer system via telephone lines or other communication links, a number of security problems arise. When we have to deal with a large population of users, massive amount of data, many communications links and a vast array of functions […] safeguards are necessary.[[109]](#footnote-109)

This was before the internet, and so the committee focused on dial-up, leased, satellite, or radio microwave links. Their focus on how to safeguard these communication links remains valid, for data for many e-governance projects continues to be sent on leased lines, both to data centers and to front-end locations. They envisaged the role of both Posts and Telegraphs and of Telecommunications to be one of ‘ensur(ing) security of data which will traverse the communication links between the men and the computers’.[[110]](#footnote-110) Much of the imagined movement was through ‘switched communication links’ which ‘pass through the public telephone exchange network’ or a ‘dedicated communication link’ which offered a ‘dedicated line between two or more computers or between a computer and a remote terminal, using data modems’.[[111]](#footnote-111) Securing the former was considered difficult, since movement depended on large number of people (telephone operators) and did not involve more than physically locking the ‘cabinets’ (nodes through which data passed).

In sum, the report envisaged a situation of data mobility through the infrastructure of the time and recommended ways by which such existing infrastructure, like the telephone switch system, could be made more secure. It also made a few generic recommendations about securing the operational apparatus, such as physically securing the site of operations, creating access protocols for personnel, backing up computer hardware and data tapes and discs, and classifying data depending on the security risks they pose and the mechanisms to control access. The report dedicated a few pages to laying out risk, recommending ‘Communications Line Safeguards’ as against ‘penetration techniques’ such as ‘masquerading’, ‘eavesdropping’, ‘piggybacking’ and ‘Line Grabbing’. The focus was on securing data as it travelled across sites, and it forewarned the breaches and attacks that government data could suffer (and indeed did suffer in the decades that followed).

A third, and more direct, involvement with managing the risks associated with data has been the government’s investment in auditing the infrastructure of digitization, including software code and data banks. Here, too, the focus was not on curtailing the movement of data, but on checking for risks in a limited way.

For digital infrastructures, an ‘audit’ includes common physical and selective checking, but also includes specific digital interventions such as maintaining automated audit logs to connect movement of data with users. The physical auditing of data is part of every digitization project that the government undertakes every time manual data transforms into a digital platform. In the digitization of land records in Karnataka, for example, digitized data was, we saw, made online only after its verification by village accountants, and in some cases by district commissioners, sometimes causing problems such as how to keep the database ‘live’ and in sync with reality. Even so, physical audit at the moment of transitioning from manual to digital continues.

A second kind of audit practice is the recording audit logs that track the history of change made to the data in the database tables. This, as a NIC DBA explained to me, is a critical component of the database, to track what changes have been made to core data and by whom. DBAs usually store the audit log in a separate table that contains columns for user id, IP address (to track from where the change was made), what changes were made (addition, deletion, modification), and the exact time at which this was done. This table is usually accessible to the ‘super admin’ of the database. Sometimes, to get around server space constraints, audit logs are stored in a separate database and a ‘dirty flag’ is used to highlight changes. A claim that I heard repeated several times by people critical of government databases is that they didn’t maintain robust audit logs, making the breach of government databases not so difficult. In any case, audit logs seem to be a critical component, applied across the board, of maintaining security within databases.

A fourth type of audit practice that has emerged after the digital infrastructure of the NeGP is of third party auditing or TPA, particularly of the SWAN. This emphasis continues the focus on securing communication links from the pre-internet days, and is on how to ensure both mobility and security. Even some of the language is the same, of ‘penetration testing’ and ‘vulnerability testing’. The difference with older attempts is that large private corporations are involved in both creating of the network and its security management.

According to a Request for Proposals for the selection of a TPA:

SWAN (State Wide Area Network) is envisaged as the converged backbone network for data, voice and video communications throughout the State/UT and is expected to cater to the information communication requirements of all the departments. Key focus of the SWAN project is on high service delivery. As per SWAN policy, all States/UTs are implementing SWAN under two Options. Under the first Option, the State is to select a suitable Public Private Partnership (PPP) model and get the SWAN commissioned and operated for 5 years by a private Network Operator. In the second Option, the SWAN for the States/UTs would be set up and operated for 5 years by the National Informatics Centre (NIC). In either of the Options a Third Party Auditor (TPA) is required.[[112]](#footnote-112)

The document then outlines the work that a TPA will be expected to undertake:

Third Party Audit shall include monitoring the performance of the SWAN with a view to ensure desired Quality of Service (QoS) by the Network Operator and bandwidth service provider, as defined in the respective SLA’s, signed between the State/UT Government, and Bandwidth Service Provider, Network Operator. These Guidelines define the broad areas of work, which TPA shall perform for a period of five years from the date of final acceptance test of the network.[[113]](#footnote-113)

PriceWaterhouseCoopers or PwC is, for example, a popular TPA in many government departments, though other firms also compete for that position. Bureaucrats generally take pride in naming these companies. Beyond physical verification, database audit logs, and employing third party vendors, some national organizations are also involved in the creation of audit protocols which were applied across multiple departments. The Comptroller & Auditor General (CAG) of India is a ‘supreme audit institution’ or SAI, one of a set of government audit institutions around the world. As a SAI, it has led a cross-country working group on IT audits since the 80s, through which, a senior director of a NIC told me enthusiastically, it has been auditing data quality, the process of data entry and data validation of major government schemes such as the National Rural Employment Guarantee Scheme (NREGS). He added that government departments are happy with CAG’s involvement because they have an oversight on the NIC.

A handbook published on IT audit by the working group states the need for such audits as a:

natural response to the increasingly computerized operations of governments and public sector organizations. While the increasing use of IT has led to improving business efficiency and effectiveness of service delivery, it has also brought with it risks and vulnerabilities associated with computerized databases and business applications, which typically define an automated working environment. The role of IT audit in providing assurance that appropriate processes are in place to manage the relevant IT risks and vulnerabilities is crucial if the SAI is to meaningfully report on the efficiency and effectiveness of government and public sector operations. In the IT audit environment, processes, tools, oversight, and other ways to manage a function are also referred to as controls.[[114]](#footnote-114)

The objectives of the CAG audit are related to data integrity, by which they mean the data that is used in decision-making and operating organizations’ core function. An ‘audit can definitively identify risks to data integrity, abuse and privacy, and also provide assurance that mitigating controls are in place’.[[115]](#footnote-115) The focus on integrity is in the service of ensuring mobility. The handbook points out that computers today communicate with each other and exchange data over networks, both public and private. It also acknowledges that:

employing overseas service providers is a common form of outsourcing, especially in a cloud computing environment, even though this poses risks involving foreign regulations on information storage and transfer may limit what can be stored and how it can be processed, data may be used by law enforcement of a foreign country without the knowledge of the organization, privacy and security standards may not always be commensurate, and disputes because of the different legal jurisdictions cannot be totally avoided.[[116]](#footnote-116)

But instead of clamping down on overseas data operations, it recommends a ‘strategy on contracting services to overseas vendors’[[117]](#footnote-117) which asks the organization to make itself aware of overseas laws and regulations, reports on a vendor’s past performance, and on ‘deviations from the Service Level Agreement and outsourcing contract’[[118]](#footnote-118) among other things.

In all these instances, we see actions dedicated to data mobility rather than its containment. They give us a new vantage point from where the current calls for the localization of data in order to secure it might be viewed.

To summarize the main arguments of this essay. The phenomenon of data excess, and its effects on the ability of governments to control information, is linked to the emergence of relational databases (among other technologies like networks), which have created infrastructure for data proliferation without necessarily ramping up expected efficiencies such as those produced in the corporate sector. Instead, the phenomenon of data excess forces citizen-beneficiaries to engage in repairing their data, producing moments of vacant citizenship, a situation I term ‘slow violence’.

The examples I have provided in this chapter are of classic bureaucracies (the bureaucracy concerned with land has been my chief example) that have undergone a significant change in their information-producing capacities with the introduction of RDBMS. Classic forms of bureaucracy have been described as ‘a remarkable form of human organization that has enabled modern governments and corporations to provide previously unimaginable benefits to humans around the world’.[[119]](#footnote-119) The question that the disruption in the flow of data that RDBMS poses is whether the organizational form of the bureaucracy will survive in the way it was imagined. In other words, in a networked digital age, does bureaucracy remain an efficient and effective apparatus for managing human affairs if its control on the information it produces is weakening?

Multiple bureaucrats in the land bureaucracy in Karnataka told me that after the land records went digital, the bureaucrats know *less* about the lands under their jurisdiction. Digital records have proliferated, but not necessarily aided bureaucracies in control. Is declining governmental effectiveness punctuated by disastrous events like a data breach, an outcome of the digital transformation that has been sweeping government since the Commission built its first centralized database?

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2. For instance, see Shira Ovide, ‘A Fix-It Job for Government Tech’, 24 November 2021, https://www.nytimes.com/2021/11/24/technology/government-tech.html. [↑](#footnote-ref-2)
3. ‘Infosys Annual Report, 1993–94’, April 1994, https://www.infosys.com/investors/reports-filings/annual-report/annual/documents/infosys-ar-94.pdf. [↑](#footnote-ref-3)
4. George Chacko, ‘INFOSYS: New Game, New Rules: A Case Study’, *Management Research News* 27.8/9 (2004): 1–25. [↑](#footnote-ref-4)
5. ‘New System for Maruti Launched’, *The Times of India*, 25 October 1994, sec. In Brief, ProQuest Historical Newspapers. [↑](#footnote-ref-5)
6. ‘Pune Bourse Goes Online’, *The Times of India*, 19 March 1996, ProQuest Historical Newspapers. [↑](#footnote-ref-6)
7. Martin Campbell-Kelly, ‘The RDBMS Industry: A Northern California Perspective’, *IEEE Annals of the History of Computing* 34.4 (2012): 19. [↑](#footnote-ref-7)
8. Paul Dourish, ‘No SQL: The Shifting Materialities of Database Technology’, *Computational Culture*, 4 November 2014, p. 2. [↑](#footnote-ref-8)
9. Arun Mohan Sukumar, *Midnight’s Machines: A Political History of Technology in India*, New Delhi: Penguin Viking, 2019. [↑](#footnote-ref-9)
10. Thomas Friedman, ‘‘Will India Seize the Moment?’’, *Seattle Post-Intelligencer*, 1924, 23 March 2004. [↑](#footnote-ref-10)
11. [Miles Brignall](https://www.theguardian.com/profile/milesbrignall), ‘HSBC Indian Call Centre Worker Accused of Hacking into Accounts’, *The Guardian*, 29 June 2006, https://www.theguardian.com/money/2006/jun/29/business.india. [↑](#footnote-ref-11)
12. Andrew Barry, Thomas Osborne and Nikolas Rose (eds), *Foucault and Political Reason: Liberalism, Neo-liberalism and Rationalities of Government*, Chicago: University of Chicago Press, 1996. [↑](#footnote-ref-12)
13. Barry et al., *Foucault and Political Reason*, p. 12. [↑](#footnote-ref-13)
14. This example has been drawn from my research for The Identity Project in 2011 and 2012, in which, among other things, I focused on the Aadhaar enrolments of Delhi’s homeless population. See Ashish Rajadhyaksha (ed), *In the Wake of Aadhaar: The Digital Ecosystem of Governance in India*, Bangalore: Centre for the Study of Culture and Society, 2013. Aadhaar is the Government of India’s biometric identity project for its billion plus residents. [↑](#footnote-ref-14)
15. Atul Kohli, ‘Politics of Economic Growth in India, 1980–2005 Part II: The 1990s and Beyond’, *Economic & Political Weekly*, 41.13 (2006): 1251–1259. [↑](#footnote-ref-15)
16. I thank Christopher Kelty at UCLA for suggesting that layers of technological forms could be thought of as strata of a geological formation. [↑](#footnote-ref-16)
17. Personal interview with the Director of NIC Shillong, Timothy Dkhar, in September 2019. [↑](#footnote-ref-17)
18. Venkat Ananth, ‘Government of India: The World’s Biggest App Factory’, *The Ken*, 17 October 2016, https://the-ken.com/story/government-india-worlds-biggest-app-factory/. [↑](#footnote-ref-18)
19. Ananth, ‘Government of India’. [↑](#footnote-ref-19)
20. National Council of Applied Economic Research, *The NCAER Land Records and Services Index (N-LRSI) 2020*, Report 20200201, February 2020, https://www.ncaer.org/publication\_details.php?pID=317. [↑](#footnote-ref-20)
21. The National e-Governance Plan is an initiative of the Government of India to make all government services available to the citizens of India via electronic media. For details, see https://www.meity.gov.in/divisions/national-e-governance-plan. [↑](#footnote-ref-21)
22. Personal interview with the Director of NIC Shillong, Timothy Dkhar, in September 2019. [↑](#footnote-ref-22)
23. ‘Over 22k Indian Websites, 114 Govt Portals Hacked’. [↑](#footnote-ref-23)
24. See ‘Chapter 6: Transfer of Personal Data Outside India’, in Committee of Experts under the Chairmanship of Justice B.N. Srikrishna, A Free and Fair Digital Economy: Protecting Privacy, Empowering Indians, Ministry of Electronics and Information Technology, Government of India, 2018, https://www.meity.gov.in/writereaddata/files/Data\_Protection\_Committee\_Report.pdf.. Also see, Parminder Jeet Singh, ‘Bringing Data under the Rule of Law’, *The Hindu*, 20 September 2018, https://www.thehindu.com/opinion/op-ed/bringing-data-under-the-rule-of-law/article24988755.ece. [↑](#footnote-ref-24)
25. Barry et al., *Foucault and Political Reason.* [↑](#footnote-ref-25)
26. Aihwa Ong, *Neoliberalism as Exception: Mutations in Citizenship and Sovereignty*, Durham: Duke University Press, 2006, p. 6. [↑](#footnote-ref-26)
27. Narasimhiah Seshagiri was a computer scientist under whose supervision the NIC was set up in the late 70s. Impressed by NIC’s ability to set up an Information Management System for the ninth Asian Games held in 1982 in Delhi, the then Prime Minister Rajiv Gandhi adopted Seshagiri’s policy on computers that set the stage for much of the e-governance to come. See Sukumar, *Midnight’s Machines*. [↑](#footnote-ref-27)
28. Lilly Irani, *Chasing Innovation: Making Entrepreneurial Citizens in Modern India*, Princeton: Princeton University Press, 2019. [↑](#footnote-ref-28)
29. Irani, *Chasing Innovation*, p. 7. [↑](#footnote-ref-29)
30. ‘Computerized Data Bank’ - Consultancy Assistance from Institutions (1976), File No. M-12038/3/76 – M&I, National Archives of India. [↑](#footnote-ref-30)
31. ‘Thick’ and ‘Thin’ is one of the many binaries in which forms of citizenship have come to be expressed, as recounted by Niraja Gopal Jayal, *Citizenship and its Discontents: An Indian History*, Cambridge, MA: Harvard University Press, 2013, p. 3. [↑](#footnote-ref-31)
32. Planning Commission, ‘Standing Committee for Directing and Reviewing Improvement of Data Base for Planning and Policy Making’, Vol. I, 1978, File No. O-11-17/1/78-M&I, National Archives of India. [↑](#footnote-ref-32)
33. Planning Commission, ‘Standing Committee for Directing and Reviewing Improvement of Data base for Planning and Policy Making’. [↑](#footnote-ref-33)
34. Planning Commission, ‘Standing Committee for Directing and Reviewing Improvement of Data base for Planning and Policy Making’. [↑](#footnote-ref-34)
35. J.G. Krishnayya et al. (eds), *sacm: A Monthly Magazine,* Pune:Systems Research Institute,1979, p. 1. [↑](#footnote-ref-35)
36. Krishnayya et al., *sacm,* p. 1. [↑](#footnote-ref-36)
37. Krishnayya et al., *sacm*, p. 1. [↑](#footnote-ref-37)
38. Krishnayya et al, *sacm*, p. 2. [↑](#footnote-ref-38)
39. Unnamed File, File No. O-11717/5/75 M&I, National Archives of India. [↑](#footnote-ref-39)
40. Krishnayya et al, *sacm*, p. 2. [↑](#footnote-ref-40)
41. Unnamed File, File No. O-11717/5/75 M&I, National Archives of India. [↑](#footnote-ref-41)
42. Yojana Bhavan, which translates to Planning Office, is a physical building which housed India’s Planning Commission since its inception in March 1950. [↑](#footnote-ref-42)
43. Planning Commission, ‘Setting up of a National Informatics Centre - Proposal from the Electronics Commission’, 1977, File No. 11017/5/77 M&I, National Archives of India. [↑](#footnote-ref-43)
44. The Electronics Commission has an interesting genesis as it was directly set up by M.G.K. Menon with the prime minister’s blessings. [↑](#footnote-ref-44)
45. Unnamed File. File No. O-11717/5/75 M&I, National Archives of India. [↑](#footnote-ref-45)
46. ‘Setting up of a National Informatics Centre - Proposal from the Electronics Commission’, File No. 11017/5/77 M&I, National Archives of India. [↑](#footnote-ref-46)
47. ‘Setting up of a National Informatics Centre’. [↑](#footnote-ref-47)
48. Michael Castelle, ‘Relational and Non-Relational Models in the Entextualization of Bureaucracy’, *Computational Culture* 3 (November 2013). http://computationalculture.net/relational-and-non-relational-models-in-the-entextualization-of-bureaucracy/. [↑](#footnote-ref-48)
49. This was between August and September 2019 at the NIC in Shillong. [↑](#footnote-ref-49)
50. Castelle, ‘Relational and Non-Relational Models’. [↑](#footnote-ref-50)
51. Castelle, ‘Relational and Non-Relational Models’. [↑](#footnote-ref-51)
52. Castelle, ‘Relational and Non-Relational Models’. [↑](#footnote-ref-52)
53. David Alan Grier, ‘The Relational Database and the Concept of the Information System', *IEEE Annals of the History of Computing* 34.4 (2012): 13. [↑](#footnote-ref-53)
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56. ‘IDM-Informix Tie-up’, *Times of India*, 24 December 1989, ProQuest Historical Newspapers. [↑](#footnote-ref-56)
57. ‘IDM-Informix Tie-up’. [↑](#footnote-ref-57)
58. Aprajita Sikri, ‘A US-Indian Database Venture’, *India Abroad*, 1 June 1990, ProQuest Historical Newspapers. [↑](#footnote-ref-58)
59. Campbell-Kelly, ‘The RDBMS Industry', p. 21. [↑](#footnote-ref-59)
60. Campbell-Kelly, ‘The RDBMS Industry', p. 22. [↑](#footnote-ref-60)
61. ‘Oracle Opens India Liaison Office’, *Dataquest*, 1991, https://itihaasa.com/describe/artefact/001\_001\_0568?referenceYear=1991. [↑](#footnote-ref-61)
62. ‘Oracle Opens India Liaison Office’. [↑](#footnote-ref-62)
63. ‘Nalanda Computer Education for RDBMS’, *The* *Times of India*, 29 May 1991, ProQuest Historical Newspapers. [↑](#footnote-ref-63)
64. ‘Overseas Appointments’, *The* *Times of India*, 20 September 1992, ProQuest Historical Newspapers; ‘Appointments,’ *The Times of India*, 6 April 1993, ProQuest Historical Newspapers; ‘Tata Unisys Ltd’, *The* *Times of India*, 28 December 1993, ProQuest Historical Newspapers. [↑](#footnote-ref-64)
65. ‘On the Move’, *The* *Times of India*, 22 March 1993, ProQuest Historical Newspapers. [↑](#footnote-ref-65)
66. Madhu Valluri, ‘How Info-tech can Help Environment’, *The Times of India*, 14 April 1993, ProQuest Historical Newspapers. [↑](#footnote-ref-66)
67. Valluri, ‘How Info-tech can Help Environment’. [↑](#footnote-ref-67)
68. ‘Pune Bourse Goes Online’. [↑](#footnote-ref-68)
69. ‘4-Day Conference Opens’, *The* *Times of India*, 8 February 1996, ProQuest Historical Newspapers. [↑](#footnote-ref-69)
70. Rajesh Y.P., ‘Software Firms Eye a Pie in Banking’, *News - India Times*, 10 July 1998, ProQuest Historical Newspapers [↑](#footnote-ref-70)
71. Moneesh Narula, ‘Bank Automation Gets Competitive’, *The Times of India*, 4 September 1993, ProQuest Historical Documents. [↑](#footnote-ref-71)
72. Narula, ‘Bank Automation Gets Competitive’. [↑](#footnote-ref-72)
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74. In the words of the international authors presenting a case study of PRS transformation in Milwaukee, ‘RDBMS-based data management, in place of the older file-based data management sub-system was being used. A decade ago, RDBMSs had been expensive and resource-intensive, and the desired user response times had been difficult to obtain in large RDBMS-based applications. Nowadays, hardware resources were no longer a constraint, and the flexible data structures possible with an RDBMS core would greatly enhance overall application flexibility’. See Shirish C. Srivastava, Sharat Mathur and Thompson Teo, ‘Modernization of Passenger Reservation System: Indian Railway’s Dilemma, *ICIS 2006 Proceedings* 98 (2006). http://aisel.aisnet.org/icis2006/98. [↑](#footnote-ref-74)
75. Srivastava et al., ‘Modernization of Passenger Reservation System’, p. 434. [↑](#footnote-ref-75)
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77. R.S. Smith, ‘Rule-by-Records and Rule-by-Reports: Complementary Aspects of British Imperial Rule of Law’, *Contributions to Indian sociology* 19.1 (1985): 153–176. [↑](#footnote-ref-77)
78. D.C. Wadhwa, ‘Guaranteeing Title to Land’, *Economic and Political Weekly* 37.47 (2002): 4704. [↑](#footnote-ref-78)
79. Personal conversation with the cofounder of Comat Technologies, Ravi Ranjan, in August 2019 in Bangalore. [↑](#footnote-ref-79)
80. Personal conversation with the director of NIC Kurukshetra in July 2018. [↑](#footnote-ref-80)
81. At the India Land and Development Conference 2020, Tim Hanstead, the CEO of Landesa, pointed out that it was ironical that India leads the world in IT, but in the 20 years that the program on land modernization has seen, very little progress has been achieved. [↑](#footnote-ref-81)
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83. Akshatha M, ‘Land Sharks Hack Bhoomi Data, Shift Government Land Title’, *The Economic Times*,10 September 2018, https://economictimes.indiatimes.com/news/politics-and-nation/land-sharks-hack-bhoomi-data-shift-government-land-title/articleshow/65749538.cms. [↑](#footnote-ref-83)
84. Bhoomi software, introduced to digitize land records, came into being in 2002. [↑](#footnote-ref-84)
85. Akshatha, ‘Land Sharks Hack Bhoomi Data’. [↑](#footnote-ref-85)
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